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DRAFT GENERIC ENVIRONMENTAL IMPACT REPORT

OPERATIONAL CHANGES AT LOGAN INTERNATIONAL AIRPORT

1977 - 1978

MASSACHUSETTS PORT AUTHORITY
Boston, Massachusetts

December, 1979

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EXECUTIVE SUMMARY

This Generic Environmental Impact Report (GEIR) evaluates the air, water and noise impacts of overall operational changes at Logan International Airport during 1978. It is only an analysis of past cumulative impacts and does not predict the impacts of future operations.

- Although airport operations (landing or take-off) increased in 1978 over 1977 by 18,500, the number of air carrier operations at Logan decreased by 2.4% during 1978. A part of this decline is attributed to the reduced operations of three air carriers -- Pan American, National, and Northwest Orient. There was a small increase in wide-body jets (DC-10, L-1011, and 747), a small increase in 4-engine jets, and a decline in 2-3 engine jet aircraft operations.

- The major increases at Logan were in commuter airlines (+22.4%) and general aviation (+28.4%). Since the increases in commuter and general aviation were in smaller aircraft, that growth did not have significant environmental effects from either a noise or an air quality standpoint.

- Air quality due to Logan activity did not change substantially in 1978. There were, however, slight increases in emissions in both aircraft and ground transportation. The largest increase in aircraft emissions was carbon monoxide due to increases in commuters and general aviation.

- The noise impacts associated with Logan's operations did not change appreciably between the two years because the decline in 2-3 engine jet operations partially offset the increases in 4-engine and wide-body jet aircraft operations.

- The percentage of FAR-36 certified aircraft flying at Logan increased from 37% in 1977 to 39% during 1978. Due to temporary changes in runway departure headings on 22R, South Boston experienced a reduction in noise impacts; however, noise levels over Quincy and surrounding areas increased.

- Due to better performance by airport operators in fuel spill prevention and control, there was some improvement in water quality in 1978.

- Massport intends to pursue balanced growth at Logan: working cooperatively with the airlines to promote economic growth within environmental guidelines.

- This study will be updated biannually. It is intended to be an effective method of accounting for the overall environmental impact of Logan operations. It has served to point out areas where data are lacking. As this data base is expanded, future updates will enable Massport to assess the overall effectiveness of the measures employed to reduce adverse environmental impacts.

I - INTRODUCTION

This Generic Environmental Impact Report (GEIR) evaluates the overall environmental impacts of changes in operations at Boston-Logan International Airport. Such an assessment is useful in order to understand and deal with the cumulative impact on surrounding communities resulting from various operational changes at the airport, and particularly changes in the fleet mix of aircraft.

In order to benefit from public comment and participation, the Massachusetts Environmental Policy Act (MEPA) process has been chosen as a vehicle for this study. An Environmental Notification Form (ENF) was filed with the Executive Office of Environmental Affairs (EOEA) on September 12, 1978.

While this document follows the general format of a Generic Environmental Impact Report in terms of organization and presentation, it is not a statutory EIR, and it also differs from the usual GEIR in two significant ways. First, it inventories past cumulative impact of airport operations rather than predicting future impact. Secondly, some of the operations and associated impacts which are assessed do not fall within the scope of activities subject to review under MEPA provisions, nor do they require Massport approval. It should also be noted that this EIR does not substitute for notification requirements or assessments of future agency actions which are subject to MEPA review.

II - PROJECT DESCRIPTION

The project to be evaluated in this document is defined as the incremental change in operations at Boston-Logan International Airport during the calendar year of 1978.

Environmental impacts resulting from overall airport operations during the study year are compared to a base year of 1977 to yield the impacts associated with the 1978 operational changes.

Since 1950 the total number of passengers serviced at Logan has increased dramatically from less than one million to well over thirteen million per year. Air carrier and commuter airline operations over the same period increased more than 320% to a current level of approximately 260,000 annually. Large increases also occurred in the amount of mail and cargo handled. It should also be noted that despite these increases, the operations at Logan were significantly lower than the forecasts made by the Federal Aviation Administration for Logan as well as for other major air carrier airports.

TABLE I

Logan Operational Characteristics: 1969-1978 (1)

Year	Total Passengers	Air Carrier and Commuter* Operations**	Air Cargo In Thousand Tons
1969	9,659,732	243,813	131.7
1970	9,361,266	244,591	145.8
1971	9,598,948	245,793	135.0
1972	10,523,455	245,468	155.0
1973	10,606,544	252,892	168.1
1974	10,606,244	229,676	170.0
1975	10,478,556	225,461	156.9
1976	11,330,992	231,887	162.9
1977	12,120,872	250,169	178.3
1978	13,543,062	259,813	189.4

*Air New England counted as Commuter Airline throughout.

**General aviation operations not included in these figures.

Aircraft operations are divided into three major categories -- air carrier, commuter and general aviation. Air carriers operate primarily large jet aircraft. Commuters generally operate piston and turbo-prop aircraft, while general aviation operations consist primarily of piston-powered aircraft, although business jets and turbo-props are also included in this category. Air New England, although certified as an air carrier, is included in the commuter figures due to the type of equipment it operates.

The number of aircraft operations at Logan by aircraft category for 1977 and 1978 are shown in Table 2 (1).

TABLE 2

Aircraft Operations by Aircraft Category

	Air Carrier	Commuter	General Aviation	Yearly Total
1977	187,039	63,130	31,222	281,391
1978	182,575	77,238	40,092	299,905
Change	-4,464	+14,108	+8,870	+18,514
% Change	-2.4%	+22.4%	+28.4%	+6.6%

First, note the drop in air carrier operations. Part of the decline is due to three air carriers -- Pan American, National, and Northwest Orient.

Pan American discontinued its scheduled Boston-London service in June of 1978. However, Pan Am has always operated a prosperous charter business from Logan and continues to do so today. In 1978, Pan Am operated 1,064 domestic and international flights at Logan compared to 1,613 in 1977.

National Airlines experienced a staged reduction in its service at Logan during 1978 and subsequently discontinued all service during mid-February 1979. A 640 flight decline from 1977 levels resulted from this reduction in service when 559 aircraft operations were recorded in 1978 (compared to 1,199 operations in 1977).

The Northwest Orient pilot strike which began on April 28, 1978 continued until the early part of August, 1978. Northwest's traffic in 1978 was 1,093, a decline of 1,049 flights from the 1977 level of 2,142.

The major reason for the decline in 1978, however, is due largely to higher load factors and larger aircraft, as well as reduction of non-jet operations as indicated in Table 3. (1)

TABLE 3

Air Carrier Operations

	1977	1978	Change	% Change
4-engine, narrow body jets (707, DC-8)	21,736	22,560	+824	3.8%
3-4 engine wide-body jets (L-1011, DC-10, 747)	18,615	19,430	+815	4.4
2-3 engine narrow body jets (DC-9, 727-, 737, BAC-111)	141,085	140,030	-1,055	-.8%
(Jet Aircraft)	(181,436)	(182,024)	(+584)	---
Other - CV580/640, L-188	5,603	555	-5,048	-90%
TOTAL AIR CARRIER OPERATIONS	187,039	182,575	-4,464	-2.4%

Based on the above numbers, it is clear that the change in total jet operations was insignificant, although there was an increase in larger jet aircraft. As indicated, much of the decline in air carrier operations was the result of a sharp decrease in non-jet aircraft, such as Eastern Airlines' retirement of its Electra* fleet.

---

* L-188 - 4 engine turbo-prop.

The number of passengers served by Logan increased by 12% from 1977 to 1978 (12,120,872 to 13,543,062). This increased volume resulted in roughly a 6.5% increase[*] in ground traffic from '77 to '78 as shown on Table 4. The numbers are rough estimates only, based on the 1972 Logan Airport Travel Study (2), updated to reflect recent operating conditions, such as increased use of Logan parking facilities. Massport is now engaged in a comprehensive origin/destination study on Logan ground access but the data are not yet available for inclusion in this report. Subsequent updating of this GEIR will reflect the new information.

TABLE 4

Estimates of Ground Traffic to and from Logan Airport by Vehicle Class in Average Daily Trips (ADT)

	1977	1978	% Change
Private Cars	43,450	46,490	7.0
Taxis	3,350	3,350	--
Rental Cars	1,720	1,810	5.5
Bus/Limousine/Livery	730	780	6.0
TOTALS	49,250	52,430	6.5%

During 1978 the passengers served by the Massport Shuttle bus operation at Logan increased by 11% over 1977 (1,308,238 to 1,452,644).

One reason ground traffic has not increased as rapidly as passengers served is due to the increased number of passengers from commuter airlines and air carriers who transfer to other flights at Logan and do not enter into the Logan ground transportation network.

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[*] Assumes an annual average increase of 6.5%

III - DESCRIPTION OF THE SURROUNDING ENVIRONMENT

Logan Airport serves an essential transportation need for the entire New England Region which is not met by any other facility. It is the only major jetport in the region.

Logan Airport lies on approximately 2250 acres of land in the heart of the Boston Metropolitan area and is bounded on three sides by the tidal waters of Boston Harbor (See Figure 1). While conveniently located nearby the downtown area of Boston and to many of its users, Logan's unique situation presents serious difficulties for residents of bordering communities. It is for this reason that Logan is one of the most seriously noise-generating airports in the United States. The problem is further compounded when one considers that a significant percentage of local residents seldom use the airport as passengers, leading to an apparent inequitable distribution of the facilities' costs and benefits. Although the benefits of Logan are widely enjoyed by air transportation users and the regional economy, the adverse environmental impacts are felt primarily by local residents alone. There are, however, employment benefits from Logan that the local community shares.

Logan borders East Boston on its western side. With a 1970 population of 38,900 the community is composed primarily of dense residential areas interspersed with various commercial establishments.

Other surrounding communities include Chelsea to the north and northwest, Revere to the northeast, Winthrop to the east and northeast, and South Boston to the south and southwest.

The city of Chelsea covers approximately 2.17 square miles of land and had a 1970 population of 30,625. (3) Two and three family housing on small

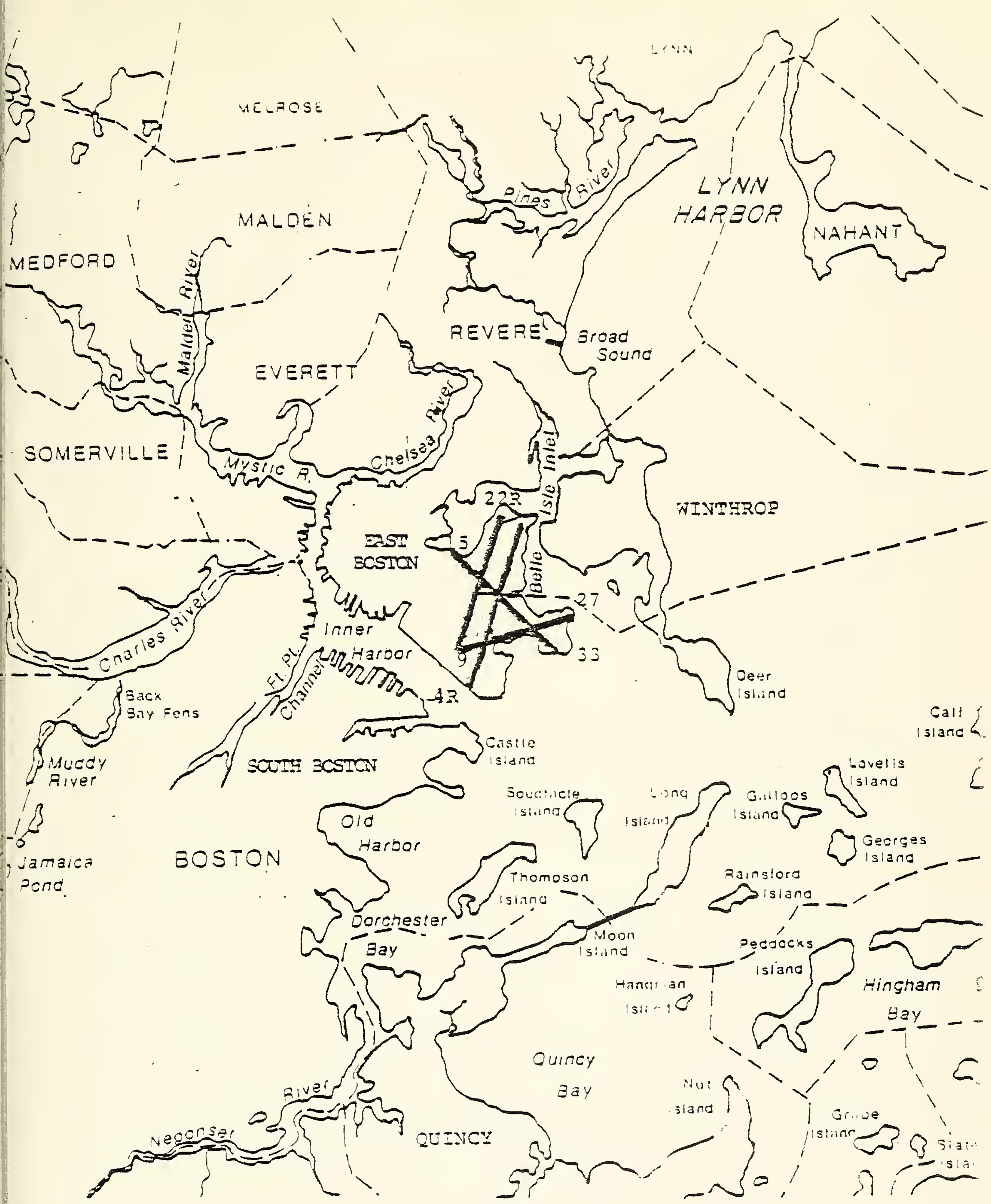


FIGURE 1

BOSTON - LOGAN AIRPORT AREA

lots along with light to heavy industry are the dominant land uses.

Revere comprises 6.32 square miles of land,much of which is marsh and tidal land. Petroleum products storage and distribution is the dominant industry, while Revere Beach is a popular recreational area. Revere had a 1970 population of 43,159. (3)

Winthrop, with a population of 20,335, is primarily a residential community with a small business district and marine recreation facilities. (3)

South Boston with a population of 38,488, is separated from Logan by Boston Inner Harbor. (3) It is a dense residential community with much industry and major port facilities.

The airport access roads lead to the McClellan Highway which in turn feed the Sumner and Callahan Tunnels in East Boston. These are the principal roadway connectors with Boston's business district and all points south and west of the city.

Boston Harbor encompasses an area of approximately 50 square miles and has 180 miles of tidal shoreline. Thirty islands covering a total land area of 1200 acres lie within the harbor. This harbor is divided into the Inner Harbor, and the Outer Harbor, which includes Dorchester Bay, Quincy Bay, and Hingham Bay. (see Figure 1).

The harbor is the largest seaport in New England, and has two major shipping channels which provide access to commercial port facilities.

In addition to commerce, recreation is a primary use of Boston Harbor waters. There are numerous beaches and boating facilities located throughout the harbor. Many of the harbor islands have been proposed for recreational development (4). However, future recreational use will be dependent upon improvement of the harbor's water quality.

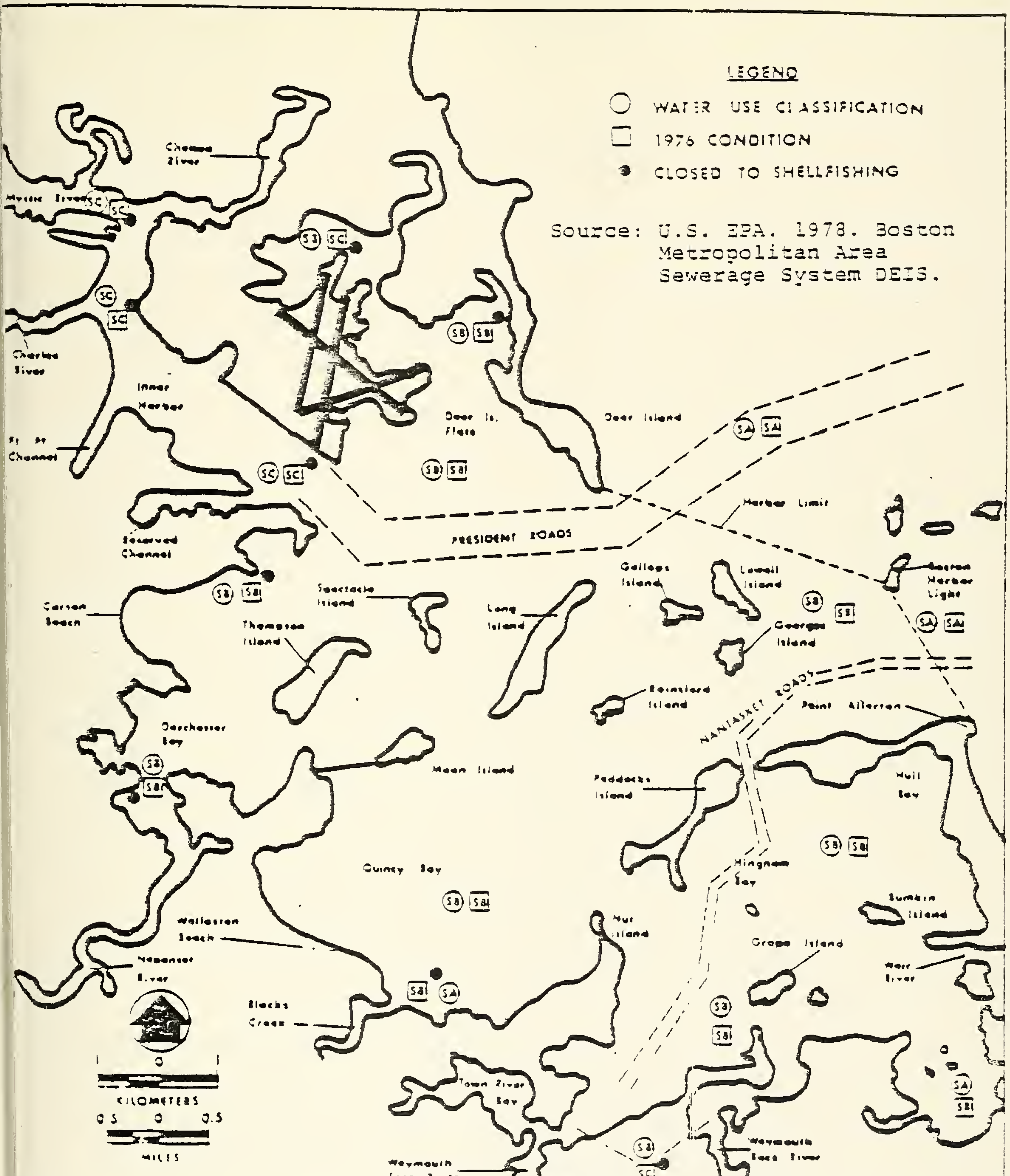
Figure 2 shows the designated water quality classifications for Boston Harbor. Classification criteria are found in Appendix A.

Shellfishing is presently closed in many areas due to pollution. The water quality problems of the harbor are due primarily to municipal wastewater and sludge discharges, along with combined sewer overflows and urban runoff (5).

Logan Airport lies within the Metropolitan Boston Air Pollution Control District. The closest ambient air quality monitoring station is located at Kenmore Square. Data from this station for 1977 and 1978 appear in Appendix B. Pollutant emissions from Logan activity have some impact on local air quality, however much of the emissions are dispersed at high altitudes or carried out over the water by prevailing westerly winds.

As is typical of all urban areas, Boston has many major sources of noise. Transportation and industrial facilities are the primary sources. Noise levels in Boston vary with both the season and the time of day and tend to decrease during the winter months and during nighttime hours. The City of Boston funded a comprehensive noise survey in 1977. The data resulting from this study is presented in Appendix C. Noise levels at sensitive receptors in the Boston area are shown in Appendix D.

East Boston, South Boston, Winthrop, Revere, and Chelsea are significantly impacted by noise from Logan. Runway 33 departures and runway 15 arrivals affect the East Boston and Chelsea communities. A residential section of South Boston lies less than one mile from the end of runway 22R. Departures on this runway as well as arrivals on runway 4 most seriously impact this area. Winthrop is primarily impacted by runway 27 arrivals and runway 9 departures. Arrivals on runway 22L, and departures on runway 4R affect Revere and Winthrop. Other communities more remote from Logan also experience noise impacts.



Source: U.S. EPA. 1978. Boston Metropolitan Area Sewerage System DEIS.

FIGURE 2
Boston Harbor Water Quality Classifications

IV - ENVIRONMENTAL IMPACTS

1 - AIR QUALITY IMPACTS

Air pollutant emissions from Logan are directly related to growth in operations. Each growth increment leads to increased emissions from additional aircraft operations, as well as from additional ground transportation. However, the effects of additional air service on local and regional air quality are less direct. The pollutants generated from each increment of new service can be calculated, but to determine resulting impact on ambient levels requires extensive dispersion modeling. Massport is now engaged in such a modeling program as part of its comprehensive Logan Air Quality Study. The results of this study will be included in future updates.

Runway utilization, flight patterns, and meteorological conditions must be accounted for in order to determine dispersion effects. Dispersion modeling techniques are not utilized in this GEIR study. Although the figures outlined in this study will not establish the actual effects of increased air pollutants, they will enable us to evaluate the change in total emissions resulting from operational changes at Logan. The effects on residents from the ground transportation emissions are easier to establish. But even here, their impact on ambient air quality is difficult to determine.

Five sources of air pollutant emissions are evaluated - aircraft operations, ground access operations, ground service vehicle operations, space heating facilities and fuel evaporation.

Table 5 lists the air pollutant emission factors by aircraft category per landing-takeoff cycle (LTO). An LTO cycle includes landing, taxiing, idling, and takeoff, and is measured from an altitude of 3,000 feet in landing

approach to 3,000 feet altitude in climb-out. It should be noted, however, that the aircraft emission contribution to air quality is most serious from zero to 500 feet above the ground. The emissions above 500 feet have considerably less effect on regional air quality. Hence, aircraft taxiing, ground transportation and part of the landing/take-off cycle are most critical.

The aircraft emission factors used in this assessment and the estimate of total aircraft emissions can be found in Tables 5 and 6.

TABLE 5

A. Air Pollutant Emission Factors per Aircraft LTO Cycle

Pollutants (kg/engine)

Aircraft Category	Carbon Monoxide	Hydrocarbons	Nitrogen Oxide	Particulates in Matter
4 Engine Jets	21.90	19.2	3.52	0.50
2-3 Engine Narrow Body Jets	9.09	2.90	4.47	0.19
3-4 Engine Wide Body Jets	21.40	8.88	11.3	0.38
Commercial (Piston & Turboprop)	11.51	1.47	0.12	0.09
Business Jets	7.17	1.60	0.73	9.05
General Aviation (Piston)	5.50	0.18	0.02	0.01

Source: U.S. EPA. 1977. Compilation of Air Pollutant Emission Factors.

B. Individual Air Pollutant Emissions Per Aircraft

(in kg)

	CO		HC		NOx		PM	
	1977	1978	1977	1978	1977	1978	1977	1978
4 Engine Jets	87.6	87.6	76.8	76.8	14.1	14.1	2.0	2.0
3-4 Engine Wide Body Jets	68.5	69.5	28.4	28.9	36.1	36.7	1.2	1.2
2-3 Engine Jets	23.0	23.5	7.3	7.5	11.3	11.5	.5	.5
Commercial	34.5	34.5	4.4	4.4	.4	.4	.3	.3

TABLE 6

Annual Pollutant Emissions Due To Aircraft Operations

A - Jet Aircraft in 10^3Kg

	CO		HC		NOx	
	1977	1978	1977	1978	1977	1978
4 engine	952.0	988.1	834.7	866.3	152.1	157.9
3-4 engine wide body	647.8	676.1	268.0	279.8	342.5	357.5
2-3 engine	1650.7	1638.4	526.2	522.3	809.8	803.8
	3250.5	3302.6	1628.9	1668.4	1304.4	1319.2
Net '78/'77		+52.1 or +1.6%	+39.5 or +2.4%		+14.8 or +1.1%	

B - Total Aircraft Emissions in 10^3Kg

	CO		HC		NOx	
	1977	1978	1977	1978	1977	1978
Jet Aircraft	3,250.5	3,302.6	1,628.9	1,668.4	1,304.4	1,319.2
Non-jet air carrier	96.9	9.6	12.3	1.2	1.0	--
Commuter	650.2	795.5	82.1	100.4	6.3	7.7
Gen. Aviation	128.8	165.2	10.0	11.8	3.1	4.1
	4,126.4	4.272.9	1,733.3	1,781.8	1,314.8	1,331.0
Net	+146.5 or +3.5%		+48.5 + 2.0%		+16.2 +1.2%	

The annual pollutant emissions due to ground access operations during 1977 and 1978 are shown in Table 7.

TABLE 7

Annual Pollutant Emissions Due To Ground Access Operations

	Pollutant Emissions (10^3kg)			
	1977	1978	Increase	%
CO	5,394.0	5,455.2	+61.2	+1.0
HC	359.6	363.6	+ 4.0	+1.0
NOx	359.6	373.6	+14.6	+4.0

Note: Emissions are estimated for an average 2.5 mile trip per vehicle on roads near or on the airport. The average trip to and from Logan exceeds that, but the above gives emission factors for adjacent communities. (EPA emission factors for mobile sources (6)).

Although the traffic flow increased by slightly more than 6%, the emissions per vehicle from the average automobile fleet mix were lowered slightly in 1978.* That accounted for little net change in air quality due to ground transportation.

With each increment in aircraft operations there is an accompanying growth in the number of ground service vehicle operations (refueling and cargo handling vehicles, etc.). Table 8 shows the annual pollutant emissions from these sources for 1977 and 1978.

---

* due to more efficient pollution controls on newer automobiles.

TABLE 8

Pollutant Emissions due to Ground Service Operations

	Pollutants (10^3Kg)			
Year	CO	HC	NOx	PM
1977	502.3	100.9	59.0	1.3
1978	503.1	101.1	60.0	1.4

Note: Ground service emission figures are estimated assuming an average of 6 support vehicles required for air carrier LTO cycle, 2 required for commuter LTO cycle, and 0.5 required for each general aviation LTO cycle. EPA mobile source emission factors (6) were used in all calcuations.

Air pollutant emissions from space heating facilities at Logan were constant during the study period. Annual emissions are shown in Table 9.

TABLE 9·

Yearly Space Heating Facility Emissions (10^3Kg)

HC	CO	NOx	PM
4763	318	63503	22861

Note: Following 1978 emission testing, David Gordon Associates, Inc. reported the Logan heating plant to be "one of the cleanest burning facilities we have encountered." (7)

Table 10 shows the annual air pollutant emissions due to evaporation of fuel at Logan.

TABLE 10

Annual Hydrocarbon Emissions due to Fuel Evaporation (10^3Kg)

1977	1978	% Change
71,710	74,730	+4.2

Note: Hydrocarbon emissions due to fuel evaporation are based on an estimated rate of loss of 0.44 lbs/10^3 gal. of aircraft fuel pumped, and 3.63 lbs/10^3 gal. of ground support vehicle fuel pumped. (8)

The total air pollutant emissions from all sources at Logan are shown in Table 11.

TABLE 11

Total Annual Air Pollutant Emissions Due To All Sources

(in 10^3Kg)

	CO		HC		NOx	
	1977	1978	1977	1978	1977	1978
Aircraft	4,126.4	4,272.9	1,733.3	1,781.8	1,314.8	1,331.0
Ground Access	5,394.0	5,455.2	359.6	363.6	359.6	373.6
Space Heating	0.3	0.3	4.7	4.7	64.0	64.0
Fuel Handling	-	-	71.7	74.7	-	-
Ground Service	502.3	503.1	100.9	101.1	59.0	60.0
	10,023.0	10,231.5	2,270.2	2,325.9	1,797.4	1,828.6
Net Change	+208.5		+55.7		+31.2	
% Increase	+2.0%		+2.0%		+2.0%	

As one can see from Table 11, the increases in air pollution are largely due to increases in aircraft operations. The CO increases are attributed largely to changes in general aviation and commuters. HC increases are due largely to the use of larger aircraft. Nitrogen oxide increases are due primarily to increases in wide-body jet aircraft.

The emissions from ground transportation tend to be low compared to those from aircraft. A partial explanation is that the pollution via automobiles is assessed primarily around the airport, not over the entire trip. The differential between 1977 and 1978, however, shows some small increases in all pollutants (particularly CO and NOx). For the purpose of the GEIR, it is the relative comparisons that are important.

As the use of wide body jets increases around Logan, there will be a downward trend in CO and HC from jet aircraft and an increase in NOx. In fact, NOx is the one pollutant around airports that can be expected to increase over the years. The comprehensive Logan Air Quality Study is now attempting to assess the overall effects of that trend. At this time, however, it is not clear precisely what effect increases in NOx will have on overall air quality.

Moves toward fewer hydrocarbons (both in gaseous and particulate forms) will go a long way in reducing the odors that people in communities adjacent to Logan now experience.

2 WATER QUALITY IMPACTS

The only significant impacts on water quality attributable to the operation of the airport are the result of those accidental spillages of aviation fuel products which find their way into the storm drainage system and are not entirely removed by pollution control devices installed at the harbor outfalls. Most spills are relatively small, and, due to containment, absorption and other control procedures, never reach the storm drainage system. However, large spills occasionally occur at fuel farm installations of such a type or magnitude that they cannot be entirely contained and entry into the storm drainage system results.

In the fall of 1977, the best "state of the art" oil skimming and absorption devices were installed in Logan's two principal storm drainage outfalls to intercept and remove any fuel accumulations which might be present, before they could reach the harbor. Although these installations were not in full automatic operation during all of 1978, they functioned effectively and were supplemented by previously employed daily visual inspection and contract oil removal services as required. These measures have been sufficiently effective to keep oil concentration of outfall effluent well within EPA limits.

Both the frequency and the size of spills were lower in 1978 than in 1977. This was the direct result of Massport's spill prevention and control efforts with the fuel farm operators. The most significant spills over the two year period were --

American Airlines Fuel Farm	March 18-20, 1977	40-50,000 gallons
TWA Farm	July 12, 1977	5,000-5,500 gallons
TWA Fuel Farm	October 26, 1977	7,000 gallons

Since the spill on October 26, 1977, fuel spills have been less frequent, and when they have occurred, they have been in much smaller quantities (up to several hundred gallons). There has been chronic spillage in the past but that has been reduced since fuel farm management has improved. In 1978 there were several small fuel spills (source unknown), but most of the oil was prevented from entering the waterways.

Water quality impacts are not directly related to growth increments at Logan. The incidence of fuel spills are a result of handling techniques and management practices, and water quality impacts are related to spill control measures. There is no direct correlation between the numbers and extent of fuel spills and aircraft operations. Thus, it is not considered appropriate to address water quality in terms of Logan growth issues.

3 - NOISE IMPACTS

Several factors make it very difficult to measure and evaluate the impact of airport operations. An important problem is the complexity of noise and of the human response to it. This section will describe these problems in detail and also describe commonly accepted measures of noise impact which will be used in this report. The large areas exposed to aircraft noise make it difficult to collect comprehensive noise measurements that will define impact. In addition, the dynamic nature of airport operations makes it difficult to interpret the data that are available to determine the effectiveness of noise abatement measures. Other aspects of this section will describe the factors which influence airport operations, the evaluation of the available noise data for 1977 and 1978 in light of the operating conditions in those years, as well as the role of the FAA and Massport's Noise Abatement Office.

Measures of Noise Impact

Sound is transmitted from vibrating objects to the ear by pressure waves traveling through the air or other media. Sound is a complex phenomenon whose description involves three variables: amplitude (perceived as loudness), frequency (perceived as pitch) and time pattern. Noise is commonly defined as misplaced or unwanted sound, a definition that entails an element of human judgment. Because of the complexity of sound and the subjective reaction to it, it is difficult to develop accurate or universally applicable predictors of the effect noise will have on people. This problem is aggravated by the need to describe different types of exposure to aircraft noise, such as: the peak noise level produced by a given aircraft operation, the total noise

exposure due to a single aircraft event or the cumulative impact of a number of events. Different measures have been developed to describe each of these types of exposure. This report will use three widely accepted measures: A - Weighted Sound Level (dBA), Equivalent Sound Level (Leq), and Day/Night Sound Level (Ldn). These measures are described below:

A - Weighted Sound Level

The basic measure of sound pressure is the decibel. The decibel scale is logarithmic, not linear, because the range of audible sound pressure is very large and the human ear is relatively insensitive to small changes.

The ear does not respond equally to all frequencies. Therefore, in order to measure sound on a scale that approximates the way it is heard by people, frequencies must be weighted according to human response. Psycho-accoustic research has led to a variety of weighting scales. The A-weighting scale is the most widely accepted. The A-weighted decibel can be used to measure an instantaneous sound level, or a steady-state noise level only. It does not measure fluctuations in sound levels or average sound levels.

Equivalent Sound Level

Since the levels of many sounds change from moment to moment, measures must be used that provide single number descriptions that correlate with human response to the time-varying sound. The Equivalent Sound Level is a commonly accepted measure of this type. It sums the A-weighted sound energy generated over a given period. It is the equivalent to the continuous A-weighted sound level which yields the same acoustic energy as the varying sounds measured over the period.

Day Night Sound Level

The Day-Night Sound Level is equal to the 24-hour Leq with a ten decibel weighting added to all noises occurring between 10:00 p.m. and 7:00 a.m., as studies of the intrusiveness of noise have shown this to be appropriate penalty for the increased annoyance of night time operations.

The Day/Night sound (Ldn) level has been adopted as the official measure of cumulative noise exposure by a number of agencies of the Federal government, including the Department of Defense, the Environmental Protection Agency (EPA) and the Department of Housing and Urban Development (HUD). EPA has identified this measure as the most appropriate descriptor of environmental noise because of its applicability to the evaluation of pervasive long-term noise, its correlation with known effects of the noise environment on the public, and its adaptability to with noise monitoring equipment in use today. HUD has formally proposed the use of Ldn to determine the acceptability of housing sites for financial assistance.

Certain empirically-derived relationships are available to help understand the significance of certain Ldn values. In recent work conducted for HUD and published in the Journal of the Acoustical Society of America[*], a consolidation of 11 social surveys taken over the last 13 years in six countries indicates a very strong relationship between the number of people expressing annoyance and the level of cumulative noise exposure which they experience on a long-term basis. For example, at Ldn 75 about 35% of the population will be highly annoyed at the noise environment. At Ldn 65 the percent of the population highly annoyed drops to about 15%, and at Ldn 55, about 5% of the people will be highly annoyed.

---

[*] (Reference: JASA, Vol. 54 (2), August 1977, p. 377)

In other work conducted for the EPA, a study of 55 case histories* led to the identification of a general relationship between community response and cumulative noise exposure. It is significant that even though it is possible to define a mean response to a given Ldn, the same response may be elicited from areas exposed to noise differing by as much as 10 or 12 db. Similarly, response can vary quite significantly at a single value of Ldn. These uncertainties are due to factors other than pure physiological reaction to noise, such as the fear of aircraft accidents, dependence on the noise source for employment, the presence or lack of goodwill and trust between the noise source and the community, and so on.

From such data, a number of Federal agencies and two states (California and Maryland) have uniformly identified two values of Ldn as having particular relevance to the compatibility of land use with the noise environment: They are Ldn 65 and Ldn 75. From HUD regulations, FAA orders, DOD directives and state laws, annual average noise exposure levels below Ldn 65 are generally regarded as acceptable for residential land use, although residents may continue to complain and be highly annoyed. HUD guidelines prohibit Federal support of residential developments in areas inside the LDN 75 contour. The 10 db range between Ldn 65 and 75 represents a transition area where special measures such as a more detailed environmental review process or sound attenuation construction may be required.

Runway Configuration and Usage

Runway use at an airport is also an important factor in assessing noise impacts because each runway leads aircraft over different areas. Changes in

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*(Reference: Community Noise, EPA report NTID 300.3, December 1971)

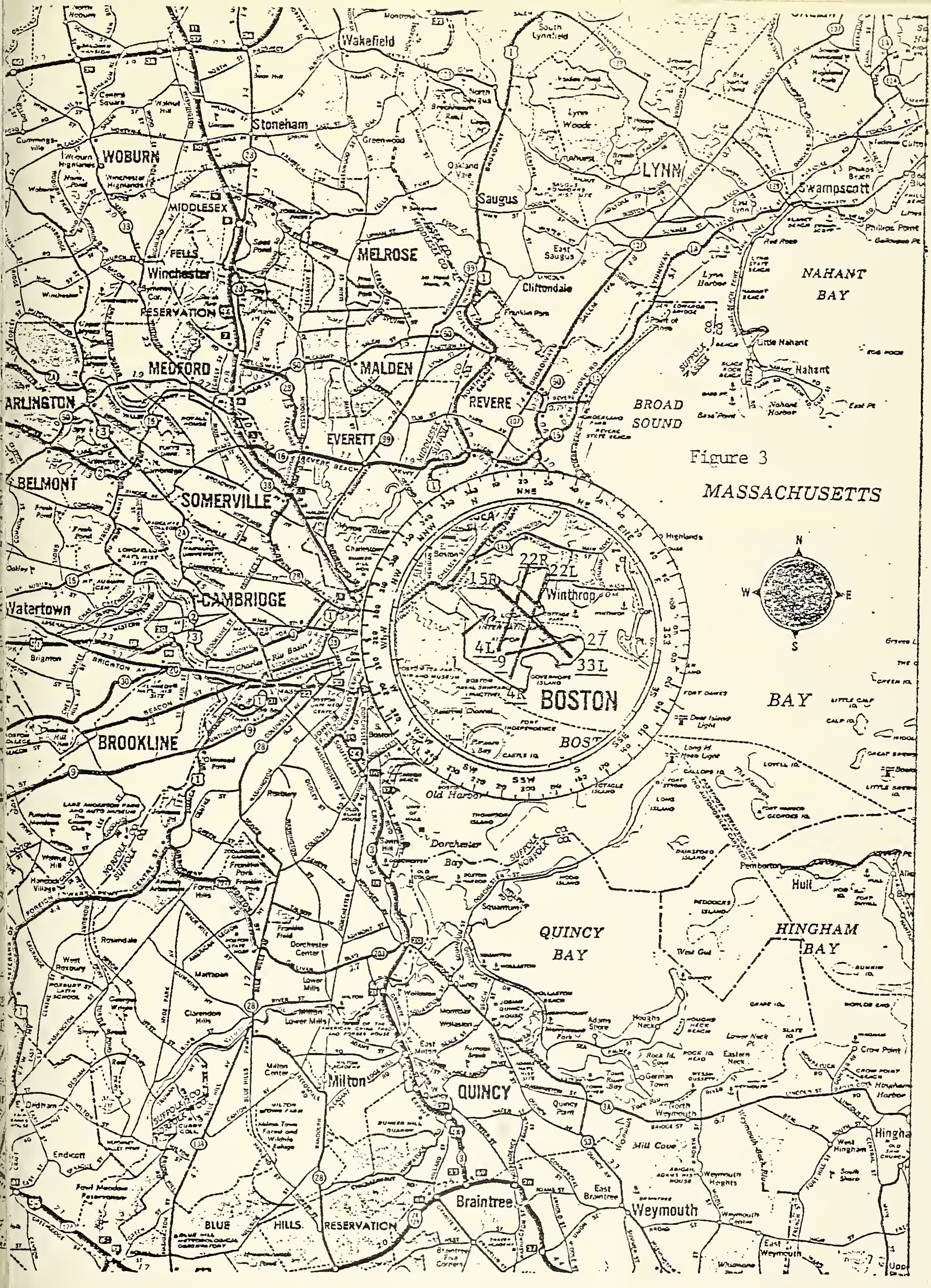

Figure 3

MASSACHUSETTS
Wakefield
South Lynnfield
Stoneham
WOBURN
Cummingsville
Woburn Highlands
Winchester Highlands
Greenwood
Oakland Vale
Saugus
Lynn Woods
LYNN
Swampscott
Phillips Beach
MIDDLESEX
FELLS
RESERVATION
Winchester
MELROSE
ESSEX CO.
MIDDLESEX CO.
East Saugus
Cliftondale
NAHANT BAY
Lynn Harbor
Little Nahant
Nahant
Nahant Harbor
East Pt.
Bass Point
MEDFORD
MALDEN
REVERE
BROAD SOUND
ARLINGTON
EVERETT
BELMONT
SOMERVILLE
Charlestown
Mystic River
CAMBRIDGE
Watertown
Brighton
Winthrop
22R
22L
15R
4L
9
27
33L
4R
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
BOSTON
BOSTON
BOSTON
BAY
Deer Island Light
Old Harbor
Thompson Island
Dorchester Bay
SUFFOLK
NORFOLK
BROOKLINE
Roxbury
Franklin Park
Forest Hills
Roslindale
West Roxbury
Mattapan
Dorchester Center
Lower Mills
Milton
Milton Lower Mills
East Milton
QUINCY
Wollaston
Squantum
QUINCY BAY
HINGHAM BAY
Hull
Pemberton
Long Island
Long Id. Head Light
Houghs Neck
Quincy Point
North Weymouth
Weymouth
East Weymouth
Braintree
East Braintree
Mill Cove
BLUE HILLS RESERVATION
Clarendon Hills
Hyde Park
Endicott
East Dedham
Fowl Meadow Reservation
West Hingham
Hingham
Crow Point
Hingham Harbor
Weymouth Heights
Weymouth Centre
Braintree Five Corners
Germantown
Rock Id. Cove
Hancock Village
Arnold Arboretum
Jamaica Pond
South Boston
Castle Id.
Fort Independence
Governors Island
Lovells Id.
Georges Id.
Calf Id.
Little Calf Id.
Green Id.
Peddocks Island
Raccoon Island
Moon Island
West Gut
Grape Id.
Slate Id.
Bumkin Id.
Worlds End
Charles River Basin

runway use from year to year are probably the single most important determinant of the spatial distribution of impact. Changes in runway use also affect the absolute level of impact, as different runways impact different numbers of people.

An understanding of the airport layout and assignment practices is a necessary antecedent to understanding the reasons that runway use changes from year to year. Figure 3 shows the runway layout of Logan Airport. Runway ends at all airports are named according to their magnetic heading. A compass has been overlaid on Figure 3 to help clarify the naming process. By convention, the magnetic runway headings are rounded to the nearest ten degrees and the zero is dropped. Because the separate ends of a runway always point in the opposite direction, their magnetic orientations differ by 180° and their designations by 18 (180 divided by 10). For example, Logan has a runway that is oriented in an east-west direction (90° east, 270° west); as such its ends are designated 9 and 27 (90 divided by 10, and 270 divided by 10), and differ by 18; (27 minus 9). Any aircraft operation in an east to west direction on the runway is Considered a Runway 27 movement. Conversely, operations from west to east are Runway 9 movements. Therefore, it should be noted that a Runway 27 arrival overflies areas to the east of the airport while a Runway 27 departure overflies areas to the west.

There are four runways (eight runway ends) at Logan which are long enough to be used by large air carrier aircraft, the primary source of noise impact. A fifth runway (15L/33R) is only long enough for use by light aircraft, such as some of those used by commuter airlines. In addition, takeoffs from Runway

4L and landings on Runway 22R are restricted to propellor-driven aircraft with maximum certificated gross takeoff weights of 12,500 pounds or less* to reduce noise impact in the Orient Heights section of East Boston. This restriction can be implemented largely because of the parallel runway 4R/22L which offers a substitute location for the restricted operations. The tower also limits air carrier arrivals on Runway 9 because the approach is obstructed by high-rise buildings and there is no instrumentation on the runway.

The FAA control tower assigns runways for takeoff and landing to each aircraft operating at the airport. Most weather and operating characteristics demand that two primary runways be used at all times: one for arrivals and one for departures. In addition, a third runway may be used for light aircraft operations. Pilots may also request a runway which is not being assigned if they determine it is more suitable because of the type of aircraft used and other operational considerations.

Conditions which require the use of a particular runway or set of runways may change very rapidly, perhaps every few hours, or may persist over several days or weeks with little interruption. Therefore, a given area may experience aircraft overflights for extended periods and then, when conditions change, may not be exposed to aircraft overflights for equal or longer periods. The overall runway utilization percentages for 1977 and 1978 are summarized in Table 12. These statistics are presented by Runway end, i.e. Runway 9 departures are combined with Runway 27 arrivals, because both impact the same area.

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* Heavier aircraft may use these runways under unusual circumstances with clearance from the tower on temporary waiver from the airport manager but this is a rare occurrence.

The FAA air traffic control tower at Logan has established a preferential order of runway selection based on noise impact. Such a preferential runway use system, in various forms, has been in effect at Logan since the mid-1950's. These procedures require that the highest priority runway combination meeting operational and capacity requirements as well as noise abatement considerations be assigned. The current procedures are shown in Appendix G. In 1977 Massport began an FAA-funded preferential runway study to identify the optimal assignment practices.

Table 12

Logan Runway Utilization 1977-1978

By Runway End

Runway	1977 %	1978 %
4R Takeoffs	4.3	3.5
22L Landings	14.9	19.2
Total	9.6	11.4
4L Takeoffs	3.6	4.1
22R Landings	3.6	1.6
Total	8.6	3.4
22L Takeoffs	2.3	2.6
4R Landings	11.4	22.1
Total	6.9	12.4
22R Takeoffs	24.8	29.5
4L Landings	6.5	6.0
Total	15.7	17.8
9 Takeoffs	14.5	21.3
27 Landings	16.7	14.1
Total	15.6	17.7
27 Takeoffs	19.3	18.0
9 Landings	.1	.5
Total	9.7	9.3
15R Takeoffs	13.5	6.4
33L Landings	34.0	29.8
Total	23.8	18.1
15L Takeoffs	--	.1
33R Landings	--	2.4
Total	--	1.3
33L Takeoffs	17.6	14.7
15R Landings	12.4	3.4
Total	15.0	9.1
33R Takeoffs	--	.1
15L Landings	--	.1
Total	--	.1

The primary constraints affecting preferential runway assignments are wind and weather conditions and demand/capacity compatibility. The FAA's runway assignment procedures set limits for allowable crosswinds and tailwinds. However, these limits leave controllers and pilots considerable latitude in runway selection. Weather conditions, including ceiling and visibility, also influence runway selection, particularly in determining the acceptability of instrument landing aids on arrival runways.

The tower must also select runway combinations which provide adequate capacity to accommodate demand with an acceptable level of delay. Runway capacity is affected by a number of factors, including:

- the number of runways which can be used simultaneously;
- whether these runways intersect, and where;
- whether taxi access crosses any of these runways;
- the extent to which light aircraft traffic (which requires higher separation from heavy traffic) can use non-interfering runways, and,
- the availability of landing aids under instrument weather conditions.

A review of the 1977-1978 runway use comparison data in Table 12 reveals significant differences in runway utilization. The specific factors causing the differences are difficult to isolate. Some of the shifts in runway utilization are disappointing. For example, Runway 15R takeoffs and 33L landings, the highest priority preferential runway assignments, declined from 1977 to 1978. This decline is partially explained by the fact that Runway 15R/33L was closed for repair work during most of July and August 1978*. However, this closing does not entirely explain the reduced use of this runway, particularly the 53 percent reduction in 15R takeoffs.

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*Runway closings for extended periods are necessary for the performance of major repair and renovation work, for the installation of new instrumentation or for other physical changes. Weather constraints require that most airfield work be accomplished in May through October. All closings are scheduled to minimize disruption of normal airport operations and adverse environmental impacts to the maximum extent feasible.

In 1977, Runway 9/27 was closed for approximately 30 days in May through July and runway 4R/22L was closed for a significant portion of July through November. In many cases the runway utilization figures do not reflect these closings; 4L and 27 landings, and 27 takeoffs increased in 1978.

Much of the unpredictability in annual runway utiliztion is due to variations in wind and weather conditions. Increases in the level of traffic demand can also affect runway assignment by requiring the use of higher capacity runway combinations. Improvements in the physical design of the airport and in instrumentation can also be very important. For example, a "Category II" instrument landing system (ILS) was installed on Runway 4R at Logan during the 1977 construction season. A Category II ILS is the most advanced instrument landing system in use in commercial aviation in the U.S. It allows aircraft to operate with lower ceilings and visibility than other systems. This improvement in the 4R instrumentation partially explains the 100 percent increase in 4R landings from 1977 to 1978.

Noise Monitoring System

Massport operates an automatic noise monitoring system which measures noise levels in communities surrounding Logan Airport. Data from this system demonstrate the effect that changes in runway use have on noise impact. The system includes 16 remote microphones that are tied into a central data-processing unit. The microphone locations are shown on Figure 4. The existing system can identify the noise associated with aircraft departures. Arrivals and ground operations typically produce noise levels that are too close to the ambient to be identified automatically.

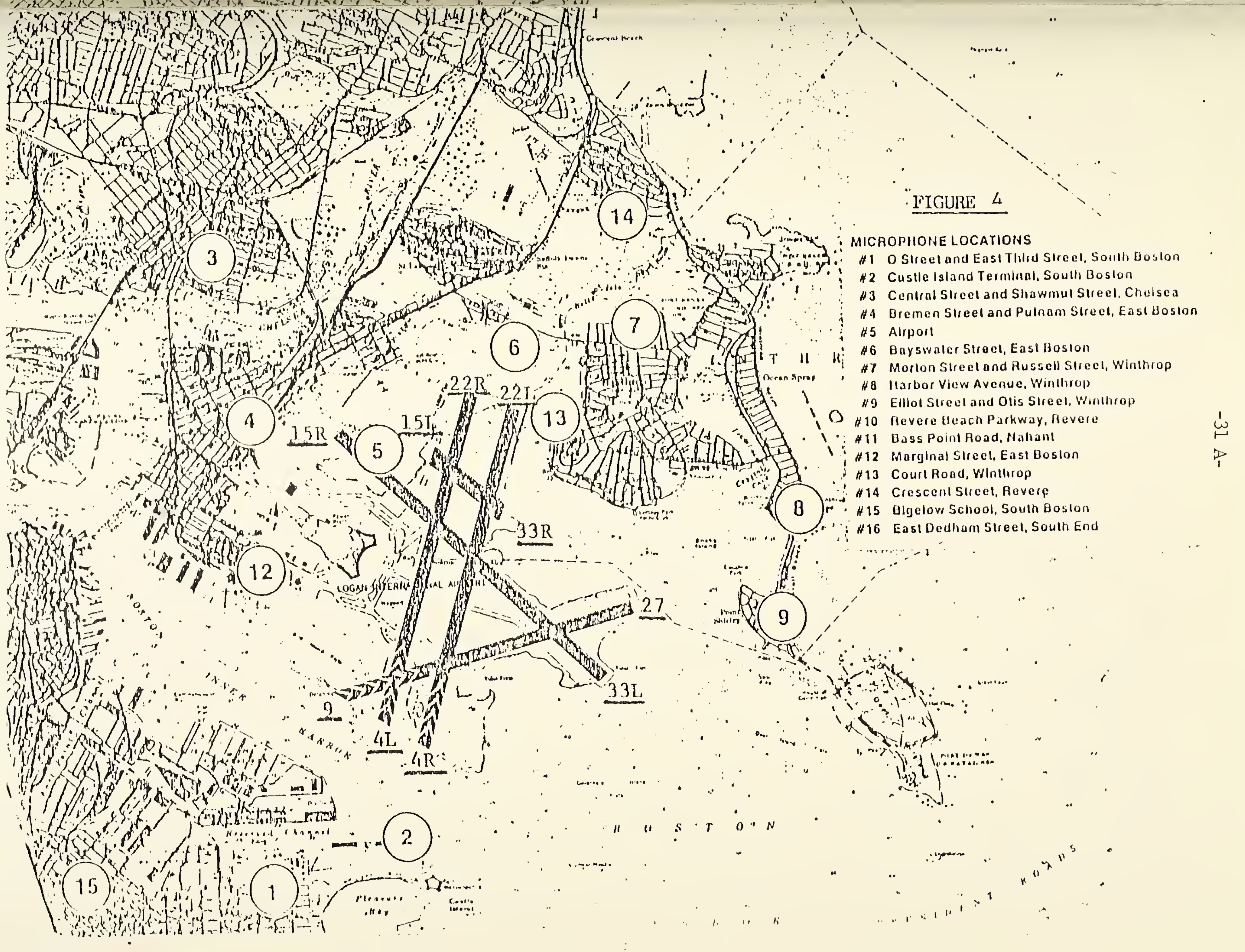

FIGURE 4

MICROPHONE LOCATIONS

#1 O Street and East Third Street, South Boston
#2 Castle Island Terminal, South Boston
#3 Central Street and Shawmut Street, Chelsea
#4 Bremen Street and Putnam Street, East Boston
#5 Airport
#6 Bayswater Street, East Boston
#7 Morton Street and Russell Street, Winthrop
#8 Harbor View Avenue, Winthrop
#9 Elliot Street and Otis Street, Winthrop
#10 Revere Beach Parkway, Revere
#11 Bass Point Road, Nahant
#12 Marginal Street, East Boston
#13 Court Road, Winthrop
#14 Crescent Street, Revere
#15 Bigelow School, South Boston
#16 East Dedham Street, South End

Table 13 lists the average peak noise levels generated on a single event basis (departure) by different aircraft types at three microphones. For comparison, Table 14 lists the dBA levels of common environmental sounds.

TABLE 13

Typical Departure Noise Levels

by Aircraft Type

(in dBA)

Microphone #: Microphone Location: Departure runway monitored:	2 Castle Island, South Boston 22R	4 Eagle Hill, East Boston 33L	8 Point Shirley, Winthrop 9
Aircraft Type			
707-100	90.8	90.8	92.2
707-300	93.3	91.7	92.7
727-100	90.0	89.4	90.9
727-200	91.0	90.0	92.3
737-200	87.1	86.4	87.7
747-100	87.8	87.4	91.0
BAC1-11	91.3	91.4	93.6
DC8-50	95.1	95.0	96.4
DC8-60	92.3	91.5	95.7
DC9-30	88.0	88.3	89.2
DC9-50	90.6	90.2	91.4
DC10-10	79.6	80.9	81.9
DC10-30	79.6	81.0	82.1
L-1011	81.2	81.0	84.0

TABLE 14

Common Environmental Noise Levels

Sound Pressure Level (dBA)	Environmental Condition
0	Threshold of hearing
10	Rustle of leaves
20	Broadcasting studio
30	Bedroom at night
40	Library
50	Quiet office
60	Conversational speech
70	Average radio
74	Light traffic noise
80	Typical factory
90	Subway
100	Symphony orchestra
110	Rock band
140	Threshold of pain

Source: White, F.A. 1975. Our Acoustic Environment.
John Wiley & Sons, Inc., New York.

The Noise Monitoring System also records cumulative noise exposure, in Leqs. The Leqs do not isolate aviation noise alone but measure the contributions of noise emanating from all sources within the community. Table 15 compares the average monthly Leqs in 1977 and 1978 for microphones 1 through 12.* These noise exposure data are presented graphically in Figure 5. This figure clearly demonstrates the variability of noise exposure. It is not possible to isolate the exact sources of this variability or the contribution of airport-related noise, because the Noise Monitoring System can only identify aircraft departures. However, because the microphones are located in areas that are exposed to high levels of aircraft noise, changes in airport operations contribute significantly to the variability in noise level. Differences in runway utilization make it difficult to evaluate the effectiveness of noise abatement procedures by comparing average noise levels at a microphone from one time period to another. This problem is compounded by the inability to isolate the contribution of non-aircraft noise sources.

However, some conclusions about the relationship of runway use and noise exposure can be drawn by comparing changes in the annual average Leqs for a given microphone to changes in the operations which affect that microphone.

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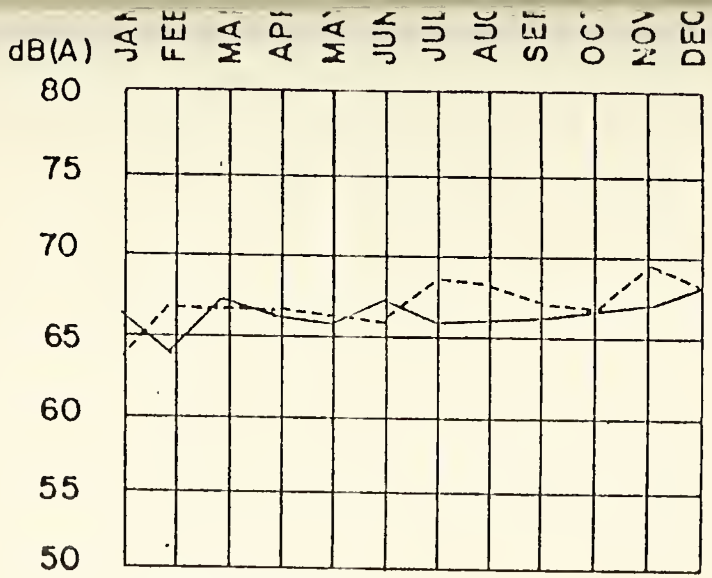
*Data are not shown for microphones 13 through 16 because they were installed in the last half of 1978 and were not in full operation until late in the year. Leqs are not given for microphone 5 because it is located on the airport property and is used only as a trigger for other microphones. In addition, data are not available for microphones 6, 10 and 12 for May through December 1978. Microphones 6 and 12 were moved in the last half of 1978 and, like the new microphones, were not in full operation until late in the year. The data from the new locations would also not be directly comparable with that from the old sites. Microphone 10 was out of order in May through December.

FIGURE

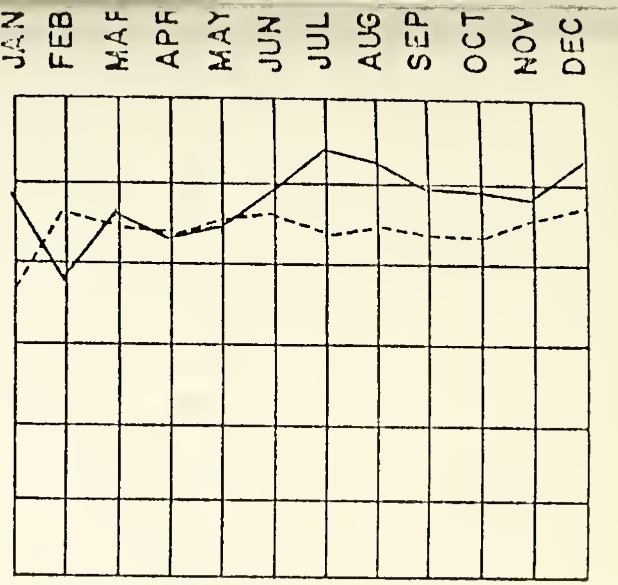
Comparative Monthly LEQ 1977 - 1978

1978 ————

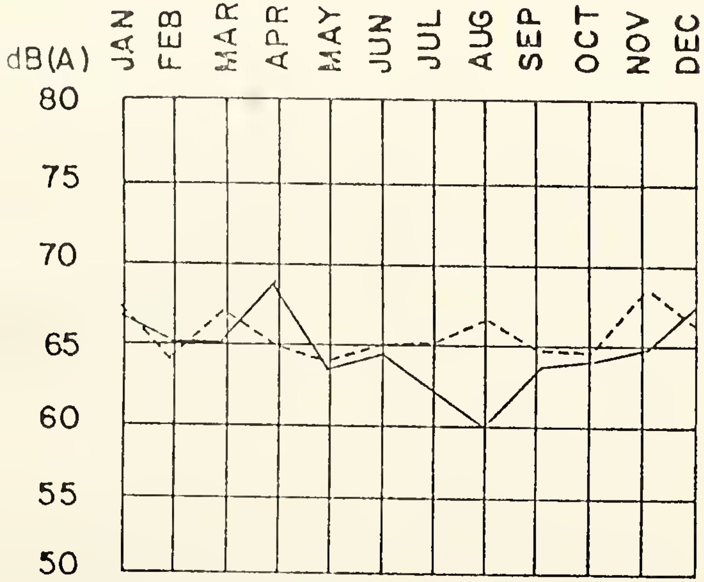
1977 - - - - - -



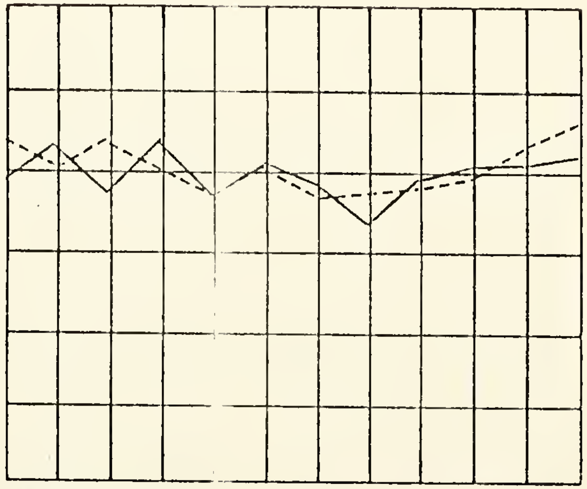
MICROPHONE 1
O STREET AND EAST THIRD STREET
SOUTH BOSTON



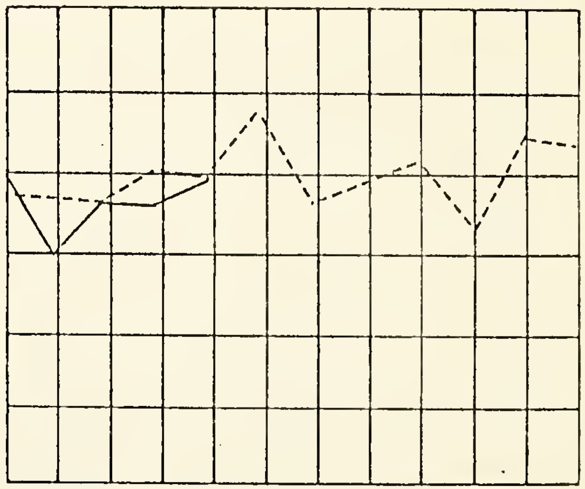
MICROPHONE 2
CASTLE ISLAND TERMINAL
SOUTH BOSTON



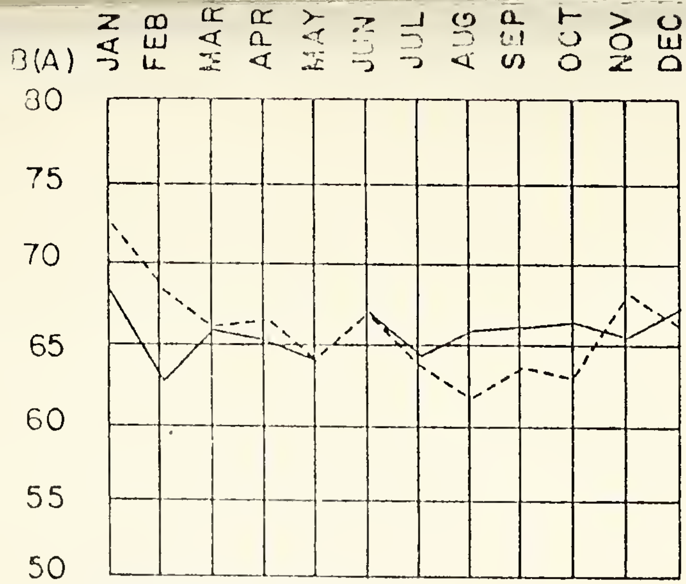
MICROPHONE 3
CENTRAL STREET AND SHAWMUT STREET
CHELSEA



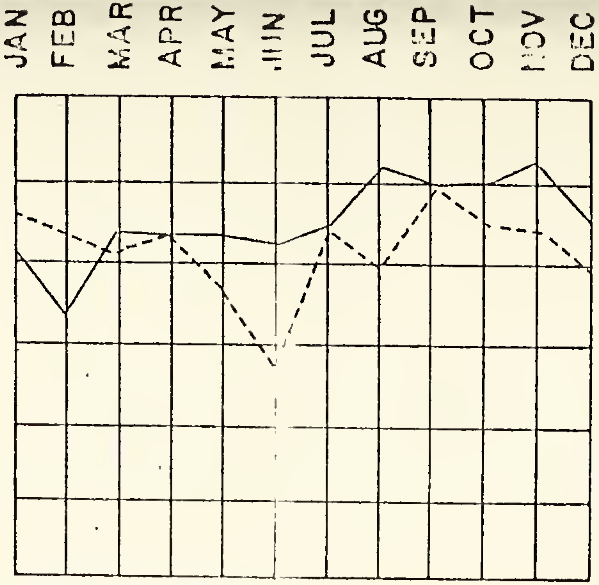
MICROPHONE 4
BREMEN STREET AND PUTMAN STREET
EAST BOSTON



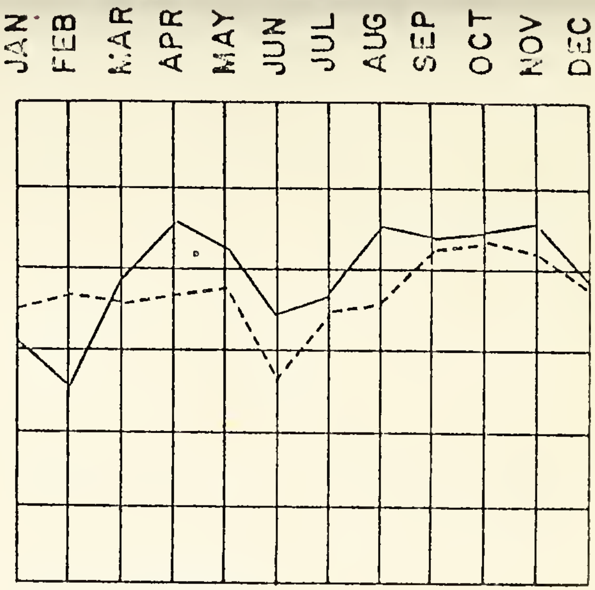
MICROPHONE 6*
BARNES AVENUE AND SHAWSHEEN ROAD
EAST BOSTON



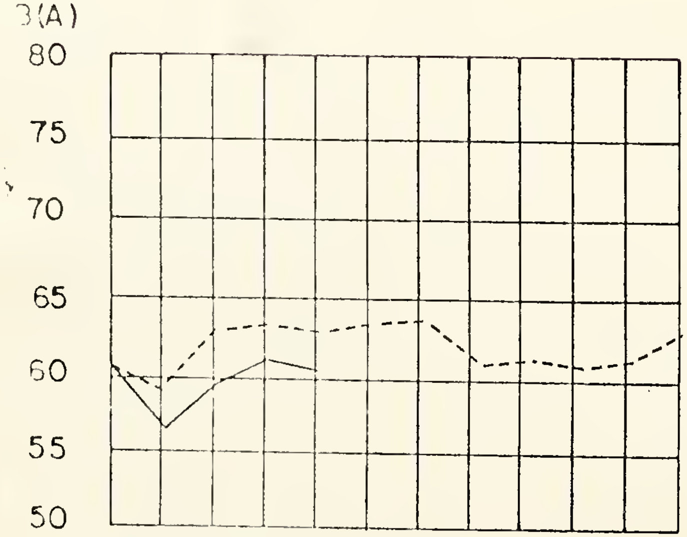
MICROPHONE 7
MORTON STREET AND RUSSELL STREET
WINTHROP



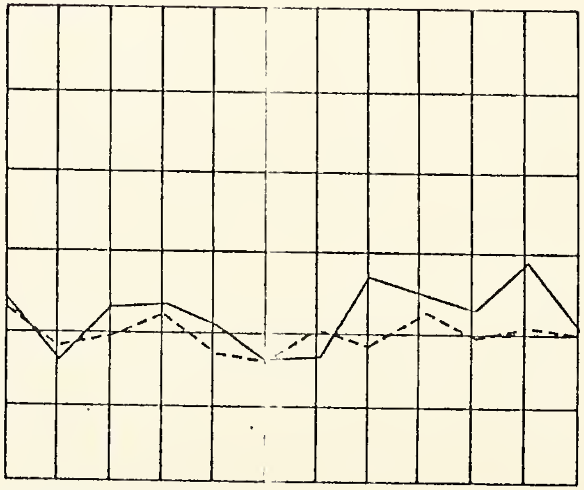
MICROPHONE 8
HARBOR VIEW AVENUE
WINTHROP



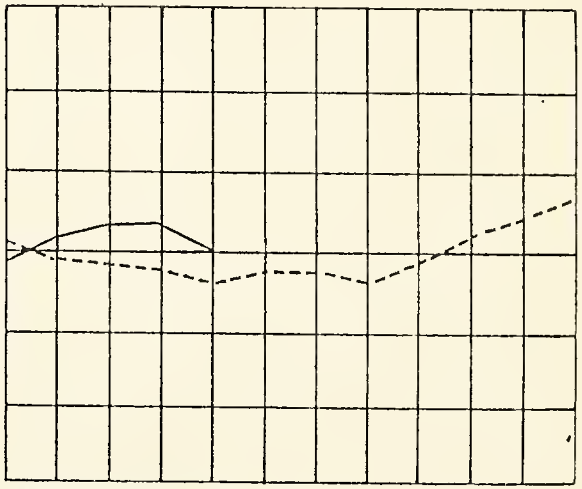
MICROPHONE 9
ELLIOT STREET AND OTIS STREET
WINTHROP



MICROPHONE 10*
REVERE STREET AND REVERE BEACH BOULEVARD
REVERE



MICROPHONE 11
BASS POINT ROAD AND TRIMOUNTAIN ROAD
NAHANT



MICROPHONE 12*
MAVERICK STREET AND ARAMON STREET
EAST BOSTON

*Data available through May only

TABLE 15

LOGAN NOISE MONITORING SYSTEM

COMPARISON OF AVERAGE MONTHLY LEQ'S, 1977 - 1978

	Microphone 1			Microphone 2			Microphone 3			Microphone 4			Microphone 6			Microphone 7		
	77	78	Change	77	78	change	77	78	change	77	78	change	77	78	change	77	78*	change
January	63.3	67.2	+3.9	68.0	74.3	+6.3	66.6	65.1	-1.5	71.7	69.0	-1.7	68.2	68.7	+0.5	71.9	68.1	-3.8
February	66.9	64.1	-2.8	73.3	69.1	-4.2	63.5	64.6	+1.1	69.8	71.0	+1.2	67.5	63.8	-3.7	67.4	62.9	-4.5
March	66.3	67.0	+0.7	72.2	72.6	+0.4	66.2	64.0	-2.2	71.2	68.2	-3.0	66.8	66.6	-0.2	66.4	65.9	-0.5
April	64.4	66.0	-0.4	72.1	71.5	-0.6	64.4	67.5	+3.1	69.5	71.3	+1.8	68.7	66.0	-2.7	67.3	65.2	-2.1
May	66.3	65.8	-0.5	73.5	73.2	-0.3	63.8	62.7	-1.1	67.7	67.6	-0.1	67.8	66.7	-1.1	64.3	64.3	0.0
June	66.2	67.2	+1.0	73.5	74.1	+0.6	65.0	64.1	-0.9	69.7	69.8	+0.1	71.7	**	--	67.6	67.8	+0.2
July	69.2	65.7	-3.5	72.1	76.6	+4.5	65.0	61.3	-3.7	67.4	67.5	+0.1	66.0	**	--	63.5	64.7	+1.2
August	68.9	65.7	-3.2	72.7	76.0	+3.3	66.2	59.1	-7.1	67.4	65.8	-1.6	67.6	75.1	--	62.0	65.9	+3.9
September	67.6	65.9	-1.7	71.4	74.7	+3.3	64.8	62.6	-2.2	68.2	68.3	+0.1	68.6	74.4	--	63.8	66.1	+2.3
October	66.8	66.3	-0.5	71.6	74.5	+2.9	64.5	63.5	-1.0	68.8	69.0	+0.2	64.2	74.4	--	62.6	66.6	+4.0
November	69.8	66.8	-3.0	72.9	74.0	+1.1	68.0	63.8	-4.2	70.5	68.7	-1.8	70.7	74.2	--	68.7	66.3	-2.4
December	68.3	67.9	-0.4	74.6	75.8	+1.2	65.8	66.3	+0.5	71.4	69.8	-1.6	69.3	74.6	--	66.7	67.2	+0.5
yr. avg.	67.6	66.4	-1.2	72.6	74.3	+1.7	65.6	64.1	-1.5	69.0	69.0	-0.7	68.5	72.2	--	66.7	66.2	+0.5

*Site moved in August, data not comparable August - December

[illegible] of order

TABLE 15

LOGAN NOISE MONITORING SYSTEM

COMPARISON OF AVERAGE MONTHLY LEQ'S, 1977 - 1978

(continued)

	Microphone 8			Microphone 9			Microphone 10			Microphone 11			Microphone 12		
	77	78	change	77	78	change	77	78	change	77	78	change	77	78	change
January	72.5	70.1	-2.4	66.5	65.0	-1.5	60.9	60.2	-0.7	60.6	61.1	+0.5	65.9	65.0	-0.9
February	70.7	66.0	-4.7	68.6	63.0	-5.6	59.3	58.7	-0.6	58.5	57.6	-0.9	65.3	65.9	+0.6
March	69.6	71.1	+1.5	68.2	69.6	+1.4	62.6	59.8	-2.8	59.3	67.0	+7.7	64.8	67.0	+2.2
April	71.2	71.2	0.0	68.7	74.0	+5.3	62.7	61.1	-1.6	60.7	61.3	+0.6	64.3	67.0	+2.7
May	68.5	71.2	+2.7	69.1	71.9	+2.8	62.4	60.4	-2.0	58.2	60.4	+2.2	63.1	64.8	+1.7
June	62.2	70.7	+8.5	62.0	67.4	+5.4	62.8	63.0	+0.2	58.5	**	--	63.8	**	--
July	71.2	72.0	0.8	67.3	68.9	+2.6	63.1	**	--	59.8	58.6	-1.2	63.7	**	--
August	69.1	75.2	+6.1	67.6	73.3	+5.7	**	**	--	59.0	63.9	+4.9	62.8	68.4	--
September	73.7	74.3	+0.6	70.9	72.7	+1.8	**	**	--	61.0	62.4	+2.4	63.8	68.0	--
October	72.4	74.4	+2.0	71.7	72.8	+1.1	60.8	**	--	59.8	61.2	+1.4	65.3	71.3	
November	71.6	76.1	+4.5	70.3	73.7	+3.4	61.0	64.0	+3.0	60.0	64.6	+4.6	66.6	70.0	--
December	69.1	71.6	+2.5	68.1	69.8	+1.7	63.0	61.2	-1.8	59.5	60.5	+1.0	67.7	69.5	
yr. avg.	71.0	73.0	+2.0	69.0	71.5	+2.5	61.9	61.9	0.0	59.7	61.7	2.0	65.0	68.2	--

*Site moved in August, data not comparable August - December
**Monitoring site out of order

This comparison is carried out in Table 16. For each microphone, the change in average Leq is compared to the change in the percentage of total operations which impact the microphone site. No comparison is included for microphone 12, because it is impacted to a great extent by ground operations and, therefore, runway use is of less importance. Operations on runways used primarily by light aircraft are not included, as these aircraft contribute little to noise exposure. For microphones 6 and 10, the comparison is for January through May only.

It should be noted that five of the ten changes in Leq shown in Table 16 are within the 1.5dB error tolerance of the Noise Monitoring System. For every microphone except number 1, the average noise level changed in the same direction as the runway utilization, as would be expected. The apparent inconsistency for microphone 1 can possibly be explained by the fact that from May through December Massport and the FAA experimented with a number of noise abatement turns for departures off of Runway 22R. These turns resulted in departure tracks which led aircraft away from microphone 1 toward microphone 2, which is in a non-residential area. Overall, noise levels decreased at six of the ten microphone locations in residential areas.

While the Noise Monitoring System is a useful tool in attempting to evaluate the impact of airport-related noise, the system in its present form does have two significant limitations: the limited number of monitoring sites and the inability to isolate the noise exposure due to aircraft operations. These limitations can be overcome however by using computer models of the operations to caluclate annual Ldn levels in all areas around the airport.

TABLE 16

COMPARISON OF CHANGES IN AVERAGE LEQS AND RUNWAY USE

1977 - 1978

icrophone	Relevant Operations	Change in Runway Use (as % of total op'ns)	Change Annual Average Noise Level	Notes
1	4R arr.	+5.4%		-Noise abatement departure procedures designed to turn aircraft away from Mic. 1 (toward Mic. 2) experimented within May - December.
	22R dept.	+2.4%		
	22L dept.	+ .2%		
	TOTAL	+8.0%	-1.2 Leq	-4L arr. primarily light aircraft.
2	4R arr.	+5.4%		-See microphone 1 notes.
	22R dept.	+2.4%		
	22L dept.	+ .2%		
	TOTAL	+8.0%	+1.7 Leq	
3	15R arr.	-5.4%		-15L/33R operations are in light aircraft only, with little effect on noise levels
	33L dept.	-1.5%		
	TOTAL	-5.9%	-1.5 Leq	
4	15R arr.	-4.5%		-See microphone 3 notes.
	33L dept.	-1.5%		
	TOTAL	-5.9%	-0.7 Leq	
6	4R dept.	-1.0%		-Runway use and noise data for January thru May only.
	22L arr.	-2.3%		
	TOTAL	-2.3%	-1.3 Leq	-4L departures and 22R arrivals in light aircraft only.
7	4R dept.	+1.0%		-See microphone 6 notes
	22L arr.	-2.3%		
	TOTAL	-1.3%	-0.5 Leq	

TABLE 16

COMPARISON OF CHANGES IN AVERAGE LEQS AND RUNWAY USE

1977 - 1978

(continued)

rophone	Relevant Operations	Change in Runway Use (as % of total op'ns)	Change Annual Average Noise Level	Notes
8	9 dept.	+3.4%		
	27 arr.	-1.3%		
	TOTAL	+2.1%	+2.0 Leq	
9	9 dept.	+3.4%		
	27 arr.	-1.3%		
	TOTAL	+2.1%	+2.5 Leq	
10	4R dept.	+1.0%		-Runway use and noise data for January through May only.
	22L arr.	-2.3		-4L departures and 22R arrivals in light aircraft only.
	TOTAL	-1.3%	-1.7 Leq	
11	9 dept.	+3.4%		
	27 arr.	-1.3%		
	TOTAL	+2.1%	+2.0 Leq	

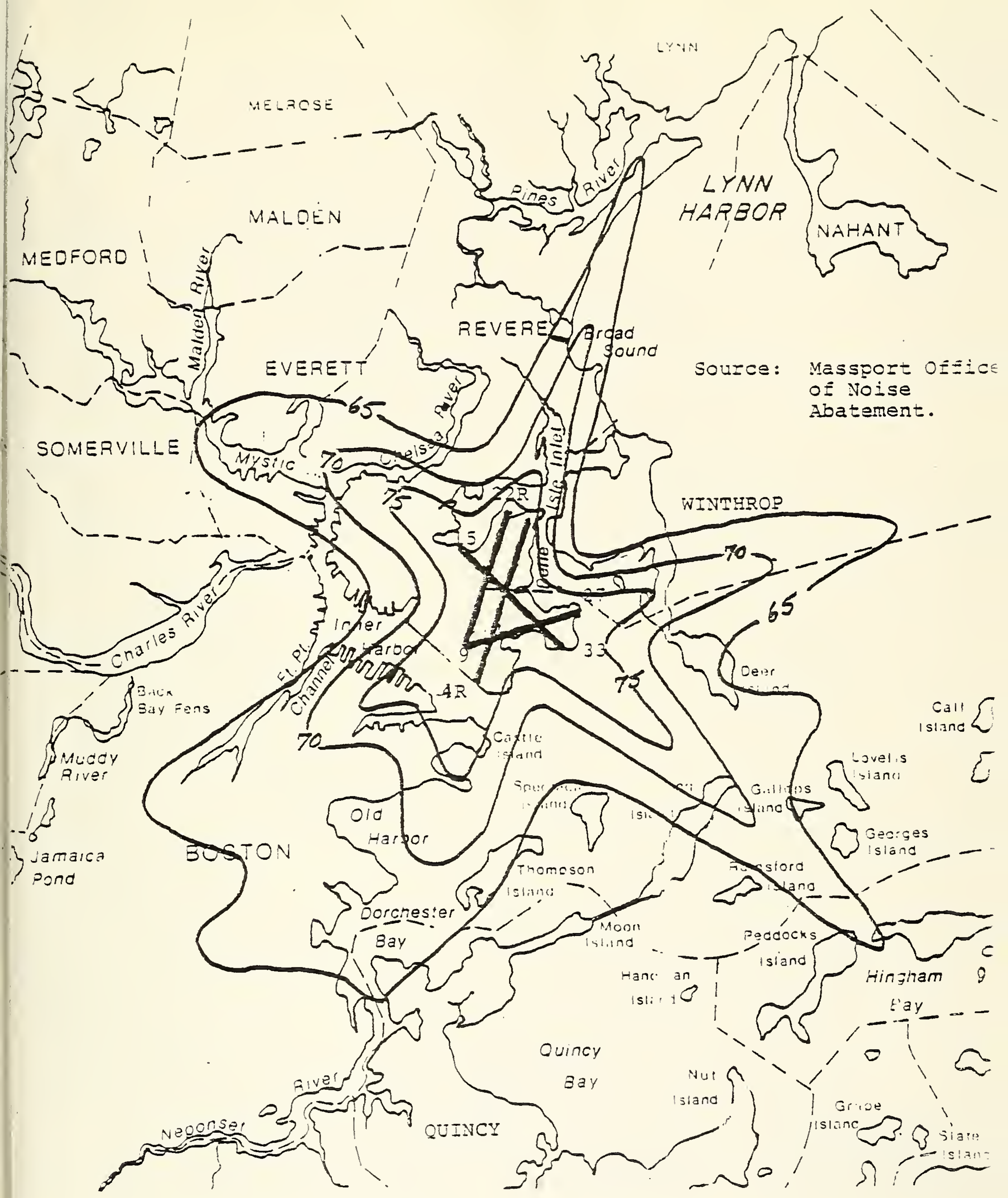
The results of these models are generally displayed using contour maps that display Ldn levels much as a topographic map displays elevations.

Ldn contours are available for two recent periods, May 1976 - April 1977 and calendar year 1978. These contours are displayed in Figures 6 and 7. It is important to note that these contours are not directly comparable, as they were developed using different computer models, which incorporate different assumptions. While the same runway utilizations (1976-1977) were used in both models, the 1978 contours model the Runway 22R departure procedure that was in use prior to May 1978. This procedure is slightly different from that which was modelled in the 1976-1977 case. All other flight tracks were the same in both cases. Therefore, the major differences between the two cases are in the level and mix of operations by aircraft type.

Noise Abatement Program

Massport has developed a diverse noise abatement program to identify and ameliorate the problem of airport noise. The Noise Monitoring System is one element of the program. Massport has also adopted a set of noise abatement rules that build on the Federal Aviation Administration's noise regulations.

By virtue of the Federal Aviation Act and other applicable provisions of law, the Federal Government, and in particular the Federal Aviation Administration, has preemptive authority and responsibility to control aircraft noise through the regulation of: 1) aircraft design and source emissions, 2) flight operational procedures, and 3) management of the air traffic control system and navigable airspace. In response to these duties, the FAA has promulgated both Federal Aviation Regulation Part 36 and Federal Aviation Regulation Part 91.



Source: Massport Office of Noise Abatement.

FIGURE 6

1977 Logan Noise Contours (Ldn).

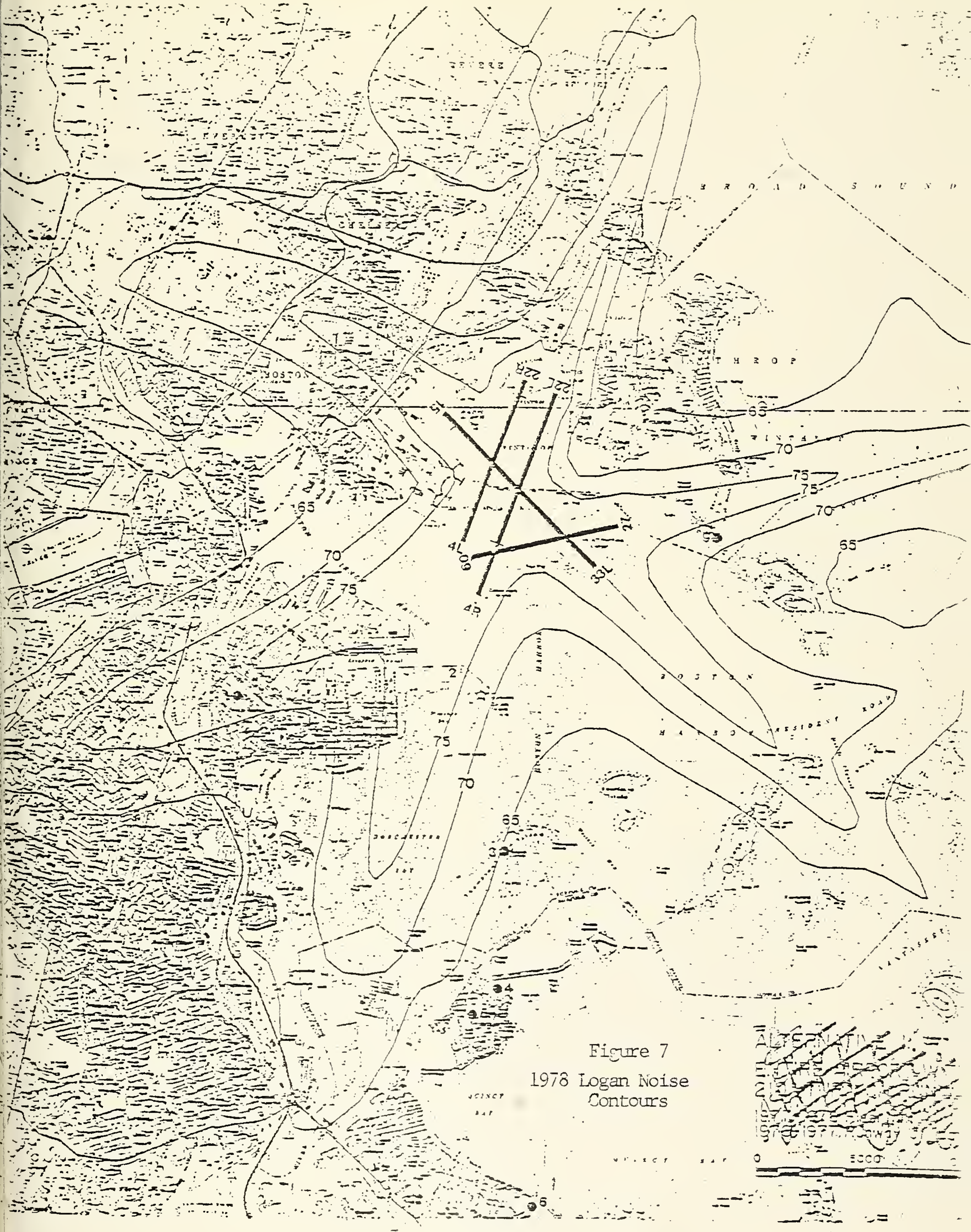


Figure 7
1978 Logan Noise
Contours

AR Part 36 reflected the efforts of the Federal Government to control aircraft noise at its source. As originally promulgated in 1969 Part 36 established noise standards for turbojet aircraft of what the FAA deemed to be new design as of December 1, 1969. An amendment in 1973 extended these same standards to all new turbojet aircraft of older design. The Regulation sets forth methods for testing noise levels emitted from various aircraft at three different stages of operation -- landing, takeoff, and sideline approach. Aircraft meeting the noise levels deemed acceptable by the FAA for the particular aircraft design in question were duly certificated under Part 36.

The second aspect of the Federal regulatory scheme, FAR Part 91, established a schedule requiring compliance with the Part 36 noise standards by jet aircraft within the domestic fleet. Part 91 allowed the individual carriers the opportunity to phase out noisier aircraft in their fleet over a period of time by requiring certain percentages of Part 36 certificated aircraft within the individual fleets by certain dates.[*]

Three Massport regulations are based on the FAR Part 36 standards, including:

1. Prohibition of operations by non FAR 36 new aircraft such as the Concorde SST and the TU-144, except in an emergency.

2. The requirement that each airline conducting a certain level of operations at Logan file an Implementation Plan setting forth the number of operations in Part 36 aircraft projected by that carrier for each month during the calendar year. These operations are reflected in a form called the "Monthly Compliance Ratio" with the numerator consisting of the projected number of monthly operations in Part 36 aircraft and the denominator consisting of the projected number of operations in all types of aircraft. The regulations require that each operator maintain the maximum feasible percentage of operations at Logan in Part 36 craft. Monthly Compliance Ratios are established by Massport's Executive Director only after a review of the data supplied by the carrier and an independent determination as to the feasibility for substituting Part 36

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[*] Legislation which would affect the implementation of this schedule is pending before the United States Congress.

craft for various non-Part 36 operations projected by the carrier. The tables that follow indicate how the utilization of Part 36 aircraft at Logan has increased since the inception of the Regulations.

3. Restriction against operation by now-exempted non-Part 36 aircraft during certain hours.

(Tables 17 and 18 demonstrate Part 36 compliance by the airlines at Logan.)

Massport has also adopted a large number of regulatory measures not related to FAR Part 36. These measures include:

1. Restrictions on full-and idle-power engine runups.

   All aircraft engine runups above idle power, except for reciprocating engine runups performed as part of pre-takeoff procedures, are prohibited between midnight and 7:00 AM. During other hours, runups can only be performed with Massport permission in specially designated areas. Idle power runups between midnight and 7:00 AM can only be conducted with Massport permission in designated areas.

2. Noise abatement holdlines.

   Holdlines have been established on the taxiways leading to the approach end of 27 and 22R. These holdlines position aircraft to reduce noise impacts in neighboring communities.

3. Restricted areas for jet and turboprop ground operation.

   Engine starts and aircraft taxiing are prohibited in certain sections of the airport near residential areas.

4. Auxiliary and ground power unit (APU and GPU) restrictions.

   APU and GPU operations are prohibited in certain areas of the airport and in other areas the aircraft must be positioned so that its fuselage shields the unit's exhaust from residential areas.

5. Prohibition on training flights.

   Flight training operations are prohibited between 11:00 PM and 7:00 AM.

6. Restricted air carrier use of 4L/22R.

   As discussed earlier, departures from Runway 4L and landings on 22R are restricted to light aircraft unless a waiver is required by unusual circumstances, which rarely occur.

7. Prohibition on intersection takeoffs.

Aircraft with maximum certificated gross takeoff weights over 30,000 pounds are prohibited from conducting intersection takeoffs. This prohibition insures that aircraft are as high as possible when they cross populated areas.

8. Displaced thresholds.

Prohibition against intentionally landing short of the displaced thresholds on Runways 4R, 22R, 22L, and 15R, except for landings on 4R during daylight hours with visual flight conditions. This rule increases the altitude of aircraft over residential areas.

9. Aircraft repositioning

Ground repositioning of empty aircraft may not be conducted under power. A rule restricting ground movements of loaded aircraft in certain areas of the airport has not been implemented pending the completion of an FAA study of its safety implications.*

Massport has also implemented a large number of non-regulatory noise abatement measures, including:

1. Angled exit taxiways

Exit taxiways with gentle curves have been added to allow higher speed turn-offs and thus less use of reverse thrust.

2. Program to reduce taxi noise.

A four part program was instituted in the southwest apron area to minimize the impacts of taxi noise. The program included the construction of a diagonal taxiway cross-connector to minimize the power required in turns, one-engine-off--taxiing, the closure of a portion of the taxiway nearest the residential area, (Jeffries Point, East Boston) and limitations on nighttime use of gates nearest the community.

3. General aviation ramp relocation

General aviation jet and turboprop parking was moved to Bird Island Flats away from the Jeffries Point community to reduce taxiing and GPU/APU noise impacts. Massport has made a committment to relocate all general aviation parking away from the Jeffries Point community in the future.

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*Furthermore, a recent enactment by the Massachusetts Legislature prohibits Massport from adopting or enforcing such a regulation.

4. Helipad relocation

   The helipad was relocated on Bird Island Flats, away from its previous location near Jeffries Point. This relocation allowed the helicopter flight track to be moved away from the community as well.

5. Approach slope instrumentation.

   Glide slope instrumentation has been installed on most runways to insure that aircraft remain at the highest possible altitude over adjacent residential areas.

6. Restriction of truck routes through residential communities and installation of pipelines to minimize fuel truck deliveries.

7. Promotion of terminal power to minimize use of APU's and GPU's. Massport has encouraged airlines to install central facilities to provide electrical power to aircraft on the ground to reduce the noise from the use of onboard APU's or mobile ground power units.

8. Soundproofing

   Massport is conducting on-going efforts to obtain federal support for the soundproofing of selected public buildings, particularly schools and hospitals.

9. Lobbying for Federal noise legislation

   Massport lobbies extensively for federal noise regulations and Federal support of local noise programs.

10. Gatehold Procedures.

    Massport is promoting increased utilization of gatehold procedures by the FAA to reduce the noise (and air pollution) of ground delays.

11. Improvements in monitoring capabilities.

    Massport has expanded the noise monitoring system and is developing a system to automatically identify and record aircraft operations, including flight tracks and altitudes. These improvements will increase Massport's ability to monitor and evaluate noise abatement procedures.

TABLE 17

Percentage of Part 36 Operations at Boston-Logan

	1977	1978	1979
January	--	38%	47%
February	--	38%	47%
March	30%	39%	45%
April	32%	37%	46%
May	37%	39%	50%
June	36%	38%	52%
July	39%	40%	50%
August	39%	39%	51%
September	36%	40%	53%
October	36%	38%	52%*
November	37%	40%	52%*
December	37%	46%	51%*

*Projected

TABLE 18

Percentage of Part 36 operations at Boston-Logan in comparison with total Industry Fleet composition of Part 36 craft.

	Total Percentage Part 36 Operations at Boston	Total Domestic Fleet Percentage Part 36 Craft
1977	37%	26%
1978	39%	29%
1979**	49%	32%

**Based on actual figures for period January-September and projected figures for the period October-December.

Massport has also encouraged the FAA to investigate noise abatement procedures. In May 1978, Massport requested that FAA evaluate flight track changes for departures on Runway 22R which involved a turn further to the east than the 210° heading in use at that time. Headings of 195° and 180° followed by the normal turn to the west after reaching 3000 ft. altitude were evaluated on an informal basis. This work identified that a heading of 195° resulted in improvements in the South Boston community at the expense of significant increases in the noise levels experienced in Squantum. Massport recommended that the FAA not consider adoption of this heading due to the significant adverse impacts. At the same time, Massport requested that the FAA continue to evaluate the 180° heading in order to improve adherence to the nominal flight track and to gain additional operating and environmental experience.

On September 11, 1978, the FAA announced that a formal evaluation (environmental impact assessment) of various departure procedures for this runway would be undertaken. The evaluation included the original 210° heading, the 180° heading, and three additional headings identified by the FAA: an initial heading to 180° followed by a further continuous climbing left hand turn over the Airport; an initial heading to 140° with subsequent interception of the BOS VOR* 160° radial bringing aircraft over Hingham Harbor prior to their westbound turn; an initial heading of 195° followed by interception of the BOS VOR 220° radial bringing aircraft up the center of Dorchester Bay prior to a westbound turn at 3000 ft. altitude.

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* BOS VOR - Boston Very High Frequency Omnidirectional Range Station ----a radio transmitter used to guide aircraft along specified courses.

Massport supported this environmental assessment by contracting with Bolt, Beranek & Newman, Inc. for an acoustic evaluation of the five procedures. The results of this evaluation were contained in a draft federal environmental impact statement that was prepared by the New England Regional Office of the FAA. Preliminary results indicated that substantial reductions in noise impact from departures on this runway could be achieved by choosing flight tracks which maximize the use of over-water airspace immediately after departure. This evaluation has also shown that aircraft adherence to a prescribed flight track is significantly enhanced through the use of the airport's navigational aid system and that lack of such precise performance can negate the environmental benefits obtained with the nominal flight track on certain alternatives.

The proposed decision which the FAA presented in its draft EIS was the use of the $195^{\circ}/220^{\circ}$ track during busy periods and the 180° track with a eventual left turn to a heading of 270° when in the judgment of the Air Traffic Control Tower, the aircraft can be handled safely and without an adverse impact in the national air transportation system. Since this decision occurred in 1979, it will be discussed in the biannual update of the GEIR.

V- MEASURES TO MINIMIZE ADVERSE ENVIRONMENTAL IMPACTS

1 - MEASURES TO MINIMIZE ADVERSE AIR QUALITY IMPACTS

One of the most effective measures to reduce air pollutant emissions at Logan is the replacement of older jet aircraft with newer, cleaner-burning aircraft. For example, the move away from 707s and DC-8s will make a significant contribution to this end.

Although both 4-engine narrow body jet aircraft and wide-body jets increased in 1978, it is expected that the trend in the future will be toward fewer of the former and more of the latter. The newer aircraft will reduce the amounts of CO, HC and particulates but will generate more NOx. From the standpoint of both odor and pollutants, the move is highly desirable.

The changes in runway use and departure headings might have an effect on air quality, depending upon the amount of queuing and delays generated. These factors will be addressed in Massport's comprehensive air quality study.

Three other measures are part of Massport's program to reduce aircraft emission at Logan. First, gate-hold procedures can be employed by the FAA whenever possible to prevent aircraft from queuing in large numbers on the taxiways. In addition to reducing the pollutant emissions due to prolonged idling, this measure conserves fuel and reduces noise impact.

Secondly, measures to avoid ground delays will be considered in all future airport planning at Logan. Aircraft are extremely inefficient at idle, as jet engines are designed for high speed performance.

Thirdly, Massport has suggested the consolidation of flights and the utilization of passenger airline belly space for cargo shipment in order to reduce the number of unnecessary aircraft operations.

With every new increment in air service, there is an accompanying increase in ground transportation to and from Logan. The ground access emissions represent about 30% of the total Logan-related emissions and are particularly important since they are emitted at ground level and have the greatest impact on local air quality.

The future increase in ground traffic will be partially offset by a move toward newer and cleaner automobiles. This, however, is not a factor which Massport can control.

A restriction in the number of parking spaces at Logan is one option available when attempting to reduce automobile traffic. Such a restriction is based on the presumption that if parking spaces are not available, the number of vehicles using the facility will decrease. Logan presently has 500 spaces out of circulation as a result of a 1975 agreement between Massport and EPA on the Boston Transportation Control Plan. It is Massport's view, however, that the freeze is not only ineffective but actually counter-productive. The unavailability of parking at Logan stimulates the development of "park and fly" operations in East Boston. In addition, a restriction on Logan parking will increase the number of drop-offs and pick-ups resulting in a larger number of vehicle miles actually travelled (because two round trips are required rather than one). Although Massport questions the effectiveness of such a freeze, it also understands that the endless proliferation of new parking facilities is not the answer either.

Massport supports a policy of providing alternatives to the automobile rather than imposing limits on its use. Shuttle bus service has rapidly increased. Massport will explore the feasibility of expanded Shuttle bus operations from the MBTA to the terminals, encourage additional limousine bus service for areas not presently covered, and continue the Share-a-Cab program.

Massport will also continue to work with the appropriate agencies on longer term projects such as the Blue Line extensions to Charles Street Station and the Airport Terminals.

Another factor to be considered is the reduction of hydrocarbons lost by evaporation at the fuel farms. More efficient vapor control measures are now being explored.

2 - MEASURES TO MINIMIZE ADVERSE WATER QUALITY IMPACTS

In January, 1978, the water pollution control units installed at the North and West outfalls went into operation. The systems, consisting of containment devices with automatic skimmers, pumps, oil/water separators, encountered difficulties, but they were operated manually during such periods so as not to compromise their containment benefits. The automatic pollution control equipment is currently undergoing modification and improvement to increase its reliability and effectiveness. Although these devices represent the best available technology, major spill containment cannot be assured under certain extreme infrequent conditions such as unusually heavy rain during a very high tide. Thus, Massport is also concentrating on a program with its tenants of reducing the likelihood of spills at the airlines' fuel farms and containing them at the source when they do occur. A retrofit of all fuel farms has now been completed, consisting of concrete retaining basins at critical locations which route runoff, including any spilled fuel, through oil water separators before discharging into the storm drains.

Massport now dispatches a pollution control team to locate and correct a spill problem whenever one is detected, and utilizes professional containment and cleanup services when necessary to avoid potential water quality impacts. The team also monitors water quality at the outfalls on a regular basis. The samples taken three times monthly in 1978 have in almost all cases shown oil/grease concentrations substantially below the 15mg/1 allowable under our EPA discharge permit. Low discharge readings are expected to continue.

Massport is continuing to work with the airlines to install spill alarms and monitoring devices at all fuel farms, as well as to install at-the-source containment systems. In addition, Massport is insisting on close supervision of all oil deliveries to minimize losses due to improper fuel handling procedures.

The measures outlined above, along with improved fuel handling techniques will keep fuel spill incidents at a minimum and assure minimal impact on water quality. We are confident that water quality around Logan can improve even though more fuel is handled.

3 - MEASURES TO MINIMIZE ADVERSE NOISE IMPACTS

Effective airport noise abatement depends upon cooperative efforts with airlines, and local, state, and federal agencies. The optimum solution is the rapid development of less noisy aircraft, since curbing noise at its source is the most satisfactory noise limitation technique. In this regard, Massport has taken a leading role among airport operators in urging the FAA and Congress first to adopt, and now to continue the federal "retrofit/replacement" rule now embodied in FAR Parts 36 and 91.

In addition, however, local programs, some within Massport's own power, and others requiring cooperation on the local and regional level, are essential. These include, of course, the continued vigorous enforcement of the Noise Abatement Rules and Rgulations Massport adopted in December, 1976. But the rules should not overshadow other opportunities through innovative airport management to improve the noise environment in the surrounding communities.

For instance, improved gate-hold procedures, reducing delays, consolidation of flights, utilization of belly space of passenger aircraft for cargo, and improved new 22-R departure headings, will all serve to abate noise, and are being pursued by Massport.

In addition, several more particularized efforts are currently underway to reduce noise impacts in the Jeffries Point area. The business jets have been relocated from an area adjacent to the community near the General Aviation Terminal to a new apron adjacent to Bravo Taxiway (near runway 4L). Also, the

helipad has been relocated from a location near Jeffries Point, to a position opposite the South Terminal. Massport intends to complete the relocation of general aviation to a site away from the community as well as to investigate the use of noise barriers as buffers for the community.

This new helipad location for instance, will make it less attractive for helicopters to follow a flight path over the community.

Some of the most important noise abatement techniques are the result of working with the FAA, which implements the programs through air traffic controller's runway assignment instructions. Massport strongly encourages runway utilization patterns which minimize the numbers of persons impacted by airport noise. The preferential runway system is subject to continuous refinement, and one of the major functions of the Massport Noise Abatement Office is the development of data and noise contours that permit the optimization of runway use patterns, as well as provide in all respects the further factual foundations for understanding the noise impacts of possible changes in Logan's service levels.

VI - REGULATORY AND MANAGEMENT OPTIONS

The recent years at Logan Airport have witnessed extraordinary changes in the levels of activity at the facility. Reflecting a nationwide upsurge in commercial aviation activity, Logan has been utilized for rapidly increasing numbers of passengers and volumes of air cargo.

	Passengers (in 000's)	Air Cargo (in 000's tons)
1976:	11,331.0	162.9
1977:	12,120.9	178.3
1978:	13,543.1	189.4

Direct environmental impacts, however, have tended not to increase as rapidly as increases in passenger or freight volume. There are a number of reasons why this is so. First, during the past several years we have witnessed environmentally desirable technological changes. The most dramatic example at Logan is greater use of wide-body jets, carrying many more passengers per landing or takeoff than the narrower body aircraft of an earlier vintage, and often with a lower single-event noise impact due to use of FAR Part 36 technology. Other examples abound, such as the improved oil spill control technology that has allowed Logan during this period to significantly diminish its adverse water quality imports.

Second, Logan's success in limiting increases in environmental impacts during a period of rising facility usage is due in major part to Massport's overall commitment to environmental responsiblity as a management objective. The noise rules and regulations are one (but by no means the only) expression of that commitment. When adopted in 1976, Logan's rules were the most agressive assertion in the nation of an airport operator's intention to control

unnecessary airport noise. From that date to the present, they have been vigorously enforced, backed by the Authority's repeated willingness to prosecute and fine in the courts any air carriers who violate the rules. Not every expectation of the rules has been fulfilled, of course, but much has been accomplished.

It is however, misleading to think that the environmental impacts associated with growth can be adequately dealt with through Massport decisions alone. Evaluation of alternative management policies must recognize, therefore, that the status quo at Logan already is an aggressive program of environmental management. It is also apparent that the environmental situation is not static and that there are significant adverse impacts from on-going growth and from projected trends which Massport cannot disregard.

In particular, the expansion of service at Logan attributable to the national program of air carrier deregulation is definitely a new circumstance that Logan's present environmental management techniques were not specifically designed to address. Since the premises of the national program are that deregulation will lead to increased competition which will in turn lead to lower air transport prices, the long-term effort of deregulation could well be continued pressure on Logan's environmental limitations. Expansion of Logan's operations, then, is a definite scenario for Logan's short-term future which must be carefully assessed in terms of possible environmental constraints.

Regulatory Options

Identification of airport management and regulatory options is an on-going process at Massport, as it is throughout the air transportation industry. The problem is complicated by divisions of regulatory jurisdiction, such as the exclusive power conferred by Congress in the Civil Aeronautics Board to regulate air carrier routes and services, subject, however, to Congressional

saving language to preserve the airport operator's proprietary rights.

There are, obviously, substantial legal issues contained in such concepts as "undue burden on commerce," "unjust discrimination" and "proprietary rights". These issues can only be answered with reference to very specific regulatory options, and, therefore, general discussions of regulatory possibilities implies no conclusion one way or the other with respect to the ultimate legality of a particular proposal suggested by the general regulatory possibilities or the power of Massport unilaterally to promulgate a particular proposal.

With the foregoing qualifiers in mind, a number of regulatory possibilities can be identified. These include:

1. Differential landing fee charges for noise abatement purposes.

Differential surcharges to deter operations by the noisiest aircraft or to shift aircraft noise incidence away from the most noise sensitive hours are now used at a number of locations in Europe and have been much discussed in the United States, but not adopted to this point. Differential charges have the appeal of "imposing the cost of polluting on the pollutor." They present, however, the drawback derived from the very fact that landing fees constitute a small percentage of air carrier operating costs. Hence, significant differentials would seem to be required to influence aircraft scheduling, and refined assessment of the scope of these differentials would be complex.

2. Single-event noise limitations. Such limitations are in place at several airports (e.g. the JFK 112 PNDB limit). The use of a single event noise limitation at Logan will be studied further.

3. Cumulative noise limitations. A number of California airports are subject to cumulative noise limitations. The problems of administering such ceilings as a noise abatement strategy pose issues of allocational reasonableness. Massport will study the California experience to see if an application suitable for Logan could be presented.

4. Cumulative operational limitations. "Ceilings" in number of operations have the surface appeal of "capping" Logan's noise growth. Whether 1) in fact a ceiling on operations would achieve that aim, 2) an operations ceiling is an appropriate strategy in view of the airport's economic role, or 3) a ceiling would be conducive to efficient management of finite environmental resources, are complex questions on which more study is required. If, for instance, Massport established a noise contour ceiling, an increment of new service would have to be evaluated in light of the actual noise levels and anticipated changes. Since each new small increment has a tiny effect on the contours, it is questionable whether such a ceiling makes sense. Although such an environmental ceiling is difficult to develop for noise, the problem is much more difficult when air quality impacts are considered. For instance, the relationship of aircraft emissions to what people actually breathe is a complicated problem, for it is virtually impossible to establish the contribution of any given increment on ambient air-quality.

5. Allocation in time of day restrictions. A curfew is one means that can be explored to curtail noise during a sensitive time frame. Three years ago Massport did explore a "curfew" and concluded that for economic reasons it should not be implemented.

Other regulatory options available to the airport proprietor are: placing limits on the use of auxiliary power units (APUS) on jet aircraft to reduce noise and air pollution, restricting the type of operations that can occur on particular runways, displacing runway thresholds to reduce noise impacts on nearby residents, providing that it could be done without reducing passenger safety.

In addition to regulatory measures, there are a variety of things an airport operator can encourage the Federal Aviation Administration to do, such as: implement gate-hold procedures to reduce taxiing noise and air pollution; implement a preferential runway system favoring operations on runways that impact the fewest number of people, and implement new departure headings and arrival procedures to reduce noise impacts.

One of the most common means used by the airport operator to reduce noise impacts is the acquisition of land to form a buffer zone between the airport and the nearby communities. But that is not a real option for Logan. Airport encroachment into the community has been understandably resisted by the East Boston residents and present Massport policy prohibits it.

In addition to the above, the airport operator can promote sound-proofing measures in nearby areas, as well as construct noise barriers to reduce airport ground noise. Both of these will be seriously studied.

Environmental impact is a real social cost of any growth increment and must be considered along with direct economic costs and benefits. Reasonable regulatory policies act to encourage beneficial growth while discouraging growth that is socially and environmentally damaging. Therefore, Massport is following a long-term policy of "balanced growth" and is working cooperatively with the airlines and community groups to promote economic growth within the social and environmental guidelines.

The options outlined above are ones that an airport operator can implement or recommend. It is however, misleading to think that the environmental impacts associated with growth can be adequately dealt with through Massport decisions alone. Massport has repeatedly petitioned before the Civil Aeronautics Board (CAB) urging that it consider environmental consequences of route awards. In the light of airline deregulation there is much uncertainty about the future of CAB activities and its relation to environmental considerations. The point to be made is that an airport operator does not have complete freedom to determine what kind of activity will occur at its facilities. For this reason Massport is convinced that work at the national level with CAB and other agencies along with cooperative efforts with the airlines is essential. Massport will continue to pursue this work on a national level.

APPENDIX A

Water Quality Criteria

Class SA - These are waters of the highest quality and are suitable for any high water quality use including bathing and other water contact activities. These waters are suitable for approved shellfish areas and the taking of shellfish without depuration, have the highest aesthetic value and are an excellent fish and wildlife habitat.

Water Quality Criteria

Item	Criteria
1. Dissolved oxygen	Not less than 6.5 mg/l at any time.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
3. Color and turbidity	None in such concentrations that will impair any uses specifically assigned to this class.
4. Total coliform bacteria per 100 ml	Not to exceed a median value of 70 and not more than 10% of the samples shall ordinarily exceed 230 during any monthly sampling period.
5. Taste and odor	None allowable
6. pH	6.8 - 8.5
7. Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.
8. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the waters for any other uses.

Item	Criteria
9. Radioactivity	None in concentrations or combinations in excess of the limits specified by the United States Public Health Drinking Water Standards.

Class SB - These waters are suitable for bathing and recreational purposes including water contact sports and industrial cooling, have good aesthetic value, are an excellent fish habitat and are suitable for certain shell fisheries with depuration (Restricted Shellfish Area).

Water Quality Criteria

Item	Criteria
1. Dissolved oxygen	Not less than 5.0 mg/l at any time.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing adequate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
3. Color and turbidity	None in such concentrations that would impair any uses specifically assigned to this class.
4. Total coliform bacteria per 100 ml	Not to exceed an average value of 700 and not more than 1000 in more than 20% of the samples.
5. Taste and odor	None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish.
6. pH	6.8 - 8.5
7. Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.

Item	Criteria
8. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other use.
9. Radioactivity	None in such concentrations or combinations in excess of the limits specified by the United States Public Health Drinking Water Standards.

Class SC - These waters are suitable for aesthetic enjoyments, for recreational boating, as a habitat for wildlife and common food and game fishes indigenous to the region, and are suitable for certain industrial use.

Water Quality Criteria

Item	Criteria
1. Dissolved oxygen	Not less than 5 mg/l during at least 16 hours of any 24 hour period nor less than 3 mg/l at any time.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
3. Color and turbidity	None in such concentrations that would impair any uses specifically assigned to this class.
4. Total coliform bacteria	None in such concentrations that would impair any uses specifically assigned to this class. See note.

Item	Criteria
5. Taste and odor	None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish.
6. pH	6.5 - 8.5
7. Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.
8. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other use.
9. Radioactivity	None in such concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

Note - No bacteria limit has been placed on Class "SC" waters because of the urban runoff and combined sewer problems which have not yet been solved. In waters of this class not subject to urban runoff or combined sewer discharges the bacterial quality of the water should be less than an average of 5,000 coliform bacteria/100 ml during any monthly sampling period. It is the objective of the Division to eliminate all point and non-point sources of pollution and to impose bacterial limits on all waters.

APPENDIX B

Kenmore Square Ambient Air Quality Data

	Pollutant			
	CO(ppm)	NO_2 (ppm)	SO_2 (ppm)	PM(ug/m^3)
1977 Mean	-	41	20	79
1977 24 hr. max.	24 (1 hr max)	79	61	305
1978 Mean	4	41	13	-
1978 24 hr. max.	20 (1 hr max)	180	179	247

Source: Mass DEQE Annual Air Quality Reports.

APPENDIX C

Boston Noise Survey Data

1977 Boston Noise Survey
(in decibels)

	L_{10} Noise Levels		L_{50} Noise Levels	
	Rush Hour	Night	Rush Hour	Night
BACK BAY				
Beacon Street	73	69	62	57
799 Boylston Street	74	71	68	64
360 Boylston Street	75	77	69	63
Dartmouth Street	79	70	73	62
Newbury Street	69	66	64	58
CHARLESTOWN				
Rutherford Avenue	82	72	78	62
Lynde & Union Streets	71	59	67	56
16 Healy Street	82	63	73	55
115 Elm Street	68	55	60	51
SOUTH END				
Dedham	72	60	67	52
Newbury & Charlesgate E.	82	75	77	68
96 West Newton Street	73	69	66	56
114 Botoph Street	71	67	65	60
11 Peterborough Street	61	56	57	50
EAST BOSTON				
123 Summer Street	67	58	59	52
Marginal Street	71	53	58	49
Maverick Street	61	52	56	47
Shelby Street	70	64	66	54
298 Paris Street	69	56	58	51
DOWNTOWN BOSTON				
Pickney Street	65	58	55	41
Elio Street	73	72	69	65
Boston Common	58	54	55	47
Federal Street	71	62	64	49
29 Beach Street	72	72	65	57
BRIGHTON-ALLSTON				
17 Shanley Street	56	51	50	46
60 Oak Square	60	60	55	53
45 Mapleton Street	50	50	46	43
23 Champney Street	59	43	53	40
5 Denby Road	64	43	57	50
50 Aldie Street	56	46	52	45
21 Holman Street	55	50	50	47

SOURCE: City of Boston Conservation Commission, 1977 Boston Noise Survey

APPENDIX D

Noise Levels at Sensitive Receptors

Boston

Schools	Noise Exposure
Sheridan School	Ldn 75-80 (NEF 45-45)
Chapman School	Ldn 70-75 (NEF 35-40)
Cheverus School	Ldn 70-75 (NEF 35-40)
Joseph P. Kennedy School	Ldn 70-75 (NEF 35-40)
Adams School	Ldn 65-70 (NEF 30-35)
Alighieri School	Ldn 65-70 (NEF 30-35)
Bradley School	Ldn 65-70 (NEF 30-35)
Guild School	Ldn 65-70 (NEF 30-35)
Lyman School	Ldn 65-70 (NEF 30-35)
McKay School	Ldn 65-70 (NEF 30-35)
O'Donnell School	Ldn 65-70 (NEF 30-35)
Otis School	Ldn 65-70 (NEF 30-35)
Umana School	Ldn 65-70 (NEF 30-35)
Webster School	Ldn 65-70 (NEF 30-35)
Condon School	Ldn 65-70 (NEF 30-35)
Gavin School	Ldn 65-70 (NEF 30-35)
O'Rielly School	Ldn 65-70 (NEF 30-35)
Perkins School	Ldn 65-70 (NEF 30-35)
Perry School	Ldn 65-70 (NEF 30-35)
South Boston High School	Ldn 65-70 (NEF 30-35)
Tuckerman School	Ldn 65-70 (NEF 30-35)
Tynan School	Ldn 65-70 (NEF 30-35)
Bancroft School	Ldn 65-70 (NEF 30-35)
Blackstone Square School	Ldn 65-70 (NEF 30-35)
Clap School	Ldn 65-70 (NEF 30-35)
Dearborn School	Ldn 65-70 (NEF 30-35)
Dever School	Ldn 65-70 (NEF 30-35)
Dillaway School	Ldn 65-70 (NEF 30-35)
Emerson School	Ldn 65-70 (NEF 30-35)
Hennigan School	Ldn 65-70 (NEF 30-35)
Hurley School	Ldn 65-70 (NEF 30-35)
J.F. Kennedy School	Ldn 65-70 (NEF 30-35)
Lewis School	Ldn 65-70 (NEF 30-35)
C. Mackey School	Ldn 65-70 (NEF 30-35)
Samuel Marson School	Ldn 65-70 (NEF 30-35)
William McCormack School	Ldn 65-70 (NEF 30-35)
Russell School	Ldn 65-70 (NEF 30-35)
Timilty School	Ldn 65-70 (NEF 30-35)
Tobin School	Ldn 65-70 (NEF 30-35)
Hospital	
Boston City Hospital	Ldn 65-70 (NEF 30-35)

Chelsea

Schools	Noise Exposure
Chelsea Hebrew Academy	Ldn 65-70 (NEF 30-35)
Chelsea Hebrew School	Ldn 65-70 (NEF 30-35)
St. Rose High School	Ldn 65-70 (NEF 30-35)
St. Stanislaus School	Ldn 65-70 (NEF 30-35)
Williams School	Ldn 65-70 (NEF 30-35)

Hospitals	
Chelsea Memorial Hospital	Ldn 65-70 (NEF 30-35)

Revere

School	Noise Exposure
Walcott School	Ldn 65-70 (NEF 30-35)

Winthrop

School	Noise Exposure
Winthrop Jr. High School	Ldn 65-70 (NEF 30-35)

Source: MASSPORT Office of Noise Abatement

APPENDIX E

FAR-36 Compliance Ratios

Air carrier

1977	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE.
Aerlingus	0	0	0	0	0	0	0	0	0	0	0	0	
Air Canada	0	0	0	0	0	0	0	0	0	0	0	0	
Air France	100	100	100	100	100	100	100	100	100	100	100	100	
Alitalia	100	100	100	100	100	100	100	100	100	100	100	100	
American	17	17	18	17	17	22	22	22	22	18	13	18	
Britsh	84	82	82	82	80	86	88	85	84	82	85	84	
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	
Delta	78	78	78	78	78	78	90	90	90	90	88	89	
Eastern	9	9	9	9	9	9	9	9	9	9	11	11	
Flying Tiger	0	0	0	0	0	0	0	0	0	0	0	0	
Lufthansa	50	53	54	52	58	62	56	54	54	55	52	53	
No. Central	6	6	6	6	6	66	6	6	8	10	10	10	
Northwest	5	5	5	5	5	5	7	7	3	10	11	12	
Sea Board	100	100	100	100	100	100	100	100	100	100	100	100	
Swiss Air	100	100	100	100	100	100	100	100	100	100	100	100	
TAP	0	0	0	0	0	0	0	0	0	0	0	0	
TIA	66	70	68	66	68	33	71	61	59	59	66	66	
TWA	25	28	27	25	28	26	26	26	24	25	32	33	
United	22	22	21	21	22	22	22	22	21	21	21	25	
Zantop	0	0	0	0	0	0	0	0	0	0	0	0	
Part 36 %total	26	27	29	32	36	35	40	40	35	35	39	39	36
Part 36 %night	72	69	71	70	76	74	72	70	74	70	71	61	
707s,DC-8s,BACs %night	8	9	3	11	9	3	10	17	14	17	12	16	

1978	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE.
Aerlingus	0	0	0	0	0	0	0	0	0	0	0	0	
Air Canada	0	0	0	0	0	0	0	0	0	0	0	0	
Air France	100	100	100	100	100	100	100	100	100	100	100	100	
Alitalia	100	100	100	100	100	100	100	100	100	100	0	0	
Allegheny	18	19	19	19	16	14	9	9	4	2	0	0	
American	20	20	23	21	24	29	30	29	27	27	26	26	
Britsh	82	80	90	86	85	84	82	83	81	83	88	86	
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	
Delta	87	87	87	87	93	93	93	93	93	93	87	87	
Eastern	16	11	15	14	16	16	17	17	16	16	17	17	
Flying Tiger	0	0	0	0	0	0	0	0	0	0	0	0	
Lufthansa	62	62	66	55	75	68	75	72	70	75	79	60	
N. Central	10	10	10	10	10	10	10	10	10	33	33	34	
Northwest	20	19	26	27	26	21	22	23	45	48	48	48	
Sea Board	100	100	100	100	100	100	100	100	100	100	100	100	
Swiss Air	100	100	100	100	100	100	100	100	100	100	100	100	
TAP	0	0	0	0	0	0	0	0	0	0	0	0	
TIA	20	25	17	25	36	0	0	0	30	28	76	32	
TWA	34	35	34	35	29	28	27	27	26	31	33	33	
United	25	24	29	21	20	28	30	30	32	30	31	31	
World	100	100	100	-	0	0	0	0	0	-	-	0	
Part 36 %total	38	38	40	37	40	38	41	40	41	38	41	47	39
Part 36 %night	54	67	65	70	58	58	68	64	68	71	69	73	
707s,DC-8s,BACs %night	28	25	28	25	37	35	28	23	27	24	24	15	

Source: MASSPORT Office of Noise Abatement.

APPENDIX F

LOGAN AIRPORT

NOISE RULES AND REGULATIONS

PART E - LOGAN AIRPORT NOISE ABATEMENT RULES AND REGULATIONS

ARTICLE I-Aircraft Noise Proposals

No new aircraft of a type not presently operating at Logan International Airport on a scheduled basis (such as the Concorde SST and the TU-144) shall use said Airport, except in an in-flight emergency, unless it meets noise standards set forth in FAR Part 36, with appendicies (14 C.F.R.).

ARTICLE II-Noise Abatement Scheduling Rule

A. Definitions:

In addition to the definitions provided in Part A of these regulations, the following additional terms shall have the following meanings, unless the context otherwise requires:

1. "Operator" shall mean an aircraft owner or operator conducting at Logan Airport two or more operations per month by jet or turbo-prop aircraft of 75,000 pounds maximum certificated gross takeoff weight or greater.

2. "Operation" shall mean a landing or takeoff.

3. "Part 36 Aircraft" shall mean an aircraft certificated in accordance with the noise emission standards of Federal Aviation Regulation Part 36 (14 C.F.R.) or a subsonic aircraft of foreign manufacture operated by a non - U.S. flag operator and certificated in accordance with comparable noise emission standards the country of its manufacture. Standards set forth in ICAO Annex 16 Part II are such comparable standards.

4. "Part 36 Operation" shall mean an operation by a Part 36 aircraft.

5. "Executive Director" shall mean the Executive Director of the Authority or his designee.

6. "Monthly Compliance Ratio" shall be a ratio composed of two numbers. The first number shall be an operator's projected monthly number of Part 36 operations at Logan. The second number shall be an operator's projected number of total monthly operations at Logan. The Monthly Compliance Ratio shall be established as hereinafter provided, and may vary from month to month within a calendar year.

B. Basic Requirement: Monthly Compliance Ratio

1. Effective January 1, 1977, each operator shall maintain on a month-by-month basis the maximum feasible percentage of operations at Logan utilizing FAR 36 aircraft, and each such operator shall

thereafter prepare and submit to the Authority for its approval an implementation plan in accordance with the requirements of this rule.

2. Effective May 1, 1977, an operator shall maintain a "Monthly Compliance Ratio" which shall be derived by one of the two methods set forth below.

(a) An operator shall attain a Monthly Part 36 Operations Ratio according to the following percentages.

1977: 50%
1978: 67%
1979: 84%
1980: 100%

or

(b) An operator shall maintain the maximum feasible ratio of Part 36 operations, as established in accordance with the provisions of this rule; except that, whenever such ratio exceeds the percentage in paragraph (a) the operator shall meet the compliance ratio provided in this paragraph.

C. Implementation Plans:

Not later than March 1, 1977, each operator shall submit to the Executive Director an implementation plan covering the calendar months March 1977 through December 1977. On September 1, 1977, and on each successive September 1, each operator shall submit an implementation plan for the months of the following calendar year.

D. Contents of Implementation Plans:

An Implementation Plan shall contain the following:

1. A detailed statement demonstrating that the operator has taken and will take every feasible measure to attain the Monthly Compliance Ratio as set forth in Section B, including a detailed statement of the reasons the operator believes the percentages in B2(a) may not be attainable, if such is the operator's belief.

2. A computation in the form hereinafter described of the carrier's proposed Monthly Compliance Ratios for the months covered by the plan.

3. A description of the carrier's program by which it will seek to improve its ability to conduct Logan operations with FAR Part 36 operations.

4. A description of each non-Part 36 schedule analyzed to determine if substitution with a Part 36 aircraft would be feasible and for each such schedule analyzed, all scheduling, operational and financial criteria used to establish such feasibility, and all supporting data developed on which the determination was made as to whether or not it was feasible to substitute a Part 36 aircraft for a non-Part 36 aircraft.

5. Computation of proposed Monthly Compliance Ratio in an operator's implementation plan shall include the following:

(a) A projection of operations at Logan for each calendar month covered by the plan showing by route and flight number or other comparable breakout the aircraft type by which the operator's operations will be conducted and whether the aircraft conducting the operation will be a Part 36 aircraft. This projection shall be based on the best available information and forecasts as of the date of the plan.

(b) A statement as to each operation not projected to be conducted by a Part 36 aircraft of the reasons the operation cannot be conducted by a Part 36 aircraft.

(c) Information in support of the projection in sufficient detail to allow the Executive Director to conduct his review of the plan as set forth below.

E. Review of Implementation Plan and Establishment of Monthly Compliance Ratio:

1. On the prescribed date for submittal of plans, the Executive Director shall publish notice of the procedures by which interested parties can inspect and comment upon the plans. This notice shall also be provided to each person whose name appears on the list maintained by the Authority under procedures for distribution of certain public notices set forth in Mass. Gen. Laws 30-A, Section 3.

2. The Executive Director shall consider comments received from interested persons, and in consultation with the Federal Aviation Administration and other interested parties as he may deem appropriate, he shall review each implementation plan in order to determine whether the proposed Monthly Compliance Ratios in fact represents each operator's maximum feasible monthly ratio of Part 36 operations at Logan.

3. In making his review, the Executive Director shall consider the operator's analysis of schedules, the criteria used to establish feasibility for substitution of Part 36 aircraft and the support data developed to determine such feasibility. The Director shall also evaluate each operation not projected in the implementation plan as a Part 36 operation, basing his evaluation on factors including but not limited to the following:

(a) Boston market demand

1. Passengers, cargo, mail to be transported indicated by route segment.

2. Schedule pattern to meet demand including prime time departures and arrivals.

3. Routing requirements beyond prime market.

4. Minimum daily frequencies.

(b) Other market requirements of airline system

1. Demand and availability of aircraft to meet requirements of route segments other than those routes serving Boston.

(c) Aircraft compatibility and availability to serve market

1. Numbers of aircraft available in fleet.
2. Passenger capacity and/or payload.
3. Aircraft range.
4. Capability of aircraft to meet unique route requirements; i.e., over water.
5. Airport compatibility; such as,
   - (a) Runway length requirements
   - (b) Pavement load-bearing capacity
   - (c) Terminal compatibility
   - (d) Noise characteristics

(d) Operating requirements

1. Fleet balancing.
2. Aircraft positioning.
3. Crew base location.
4. Maintenance requirements.

(e) Financial considerations

1. Revenue versus operating costs.

(f) Availability of Complying Aircraft

1. Total number of aircraft available in airlines fleet to meet total system-wide airline scheduling requirements versus total number of complying aircraft available in airline fleet to meet Boston scheduling requirements.

4. In the event that the Executive Director determines that the proposed Monthly Compliance Ratios do represent the maximum feasible ratios, he shall proscribe those ratios as the Monthly Compliance Ratios for purposes of this regulation and shall issue public notice to those parties in accordance with the procedures in E.1. above. In the event he determines that the proposed Monthly Compliance Ratios do not represent the maximum feasible ratios, he shall proceed to determine, as set forth below, substitute Monthly Compliance Ratios to be used in lieu of the proposed ratios.

5. To determine substitute monthly compliance ratios, the Executive Director shall proscribe the ratio which he believes is appropriate having regard for the factors set forth above for his use in his initial plan review. The ratios so determined by the Executive Director shall be the Monthly Complaince Ratios for purposes of this regulation. Such Monthly Compliance Ratios may be adjusted upon written request by the operator, in the event that flights are added to or deleted from the schedule.

G. An operator shall conduct no fewer Part 36 operations at Logan in any calendar month than the number of Part 36 operations established in the Monthly Compliance Ratios. Each operation by which actual Part 36 operations falls short of the Part 36 operations component of the Monthly Compliance Ratio is a violation of this regulation.

H. Within ten(10) days of the end of a calendar month, each operator shall submit, in a form satisfactory to the Authority, a report of the actual number of Part 36 operations and total operations conducted in that calendar month.

I. The Executive Director shall propose that the Authority assess a penalty for violation of this regulation based on the applicable schedule of fines set forth in the by-laws of the Authority. In assessing such a penalty the Authority or a member or members as it may designate, shall conduct an adjudicatory proceeding which meets the requirements of Mass. Gen. Laws, Chapter 30A together with all other requirements of law. The scope of that adjudication shall include the validity of the Monthly Compliance Ratio as the maximum feasible ratio of Part 36 operations at Logan in accordance with the purposes of this rule. The adjudication shall also take account of unforseen exigencies beyond the control of the operator including but not limited to labor disputes and cancellation of particular services due to bad weather.

ARTICLE III - Late Night Aircraft Restriction

A. Restricted Aircraft:

During the hours prescribed in the compliance schedule herein, no jet or turboprop aircraft not certificated in accordance with Federal Aviation Regulation Part 36 shall take off or land at Logan Airport except as required by in-flight emergency.

Compliance Schedule:

1977	1:00 a.m. - 6:00 a.m.
1978	12:00 a.m. - 6:00 a.m.
1979	11:00 p.m. - 6:30 a.m.
1980	10:30 p.m. - 6:30 a.m.
1981 and thereafter	10:00 p.m. - 7:00 a.m.

B. Exemptions:

1. An aircraft (except an aircraft restricted for operations at Logan pursuant to Article I of this Part E) will be exempted from this regulation upon certification in a form satisfactory to the Airport Manager that the aircraft has undergone or will undergo phased mechanical maintenance, inspection or modification at Logan over a period of not less than twenty-four hours, and that exemption from this regulation is required in order for the procedures to be conducted at Logan.

2. An aircraft in certificated air carrier service arriving or departing Logan subsequent to a published scheduled time of arrival or departure will be exempted from this regulation upon completion of a report in a form satisfactory to the Airport Manager setting forth the reasons that the arrival or departure of the aircraft was delayed.

3. A specific operation by a non-FAR Part 36 aircraft which is substituted for a scheduled Part 36 certificated aircraft will be exempted from this regulation upon completion of a report in a form satisfactory to the Airport Manager which establishes that said substitution was necessitated by unanticipated mechanical or operational considerations rendering the scheduled Part 36 aircraft unable to perform that specific operation and that no other Part 36 aircraft was available for substitution.

4. Aircraft performing operations in all-cargo service which are scheduled as of the date of the adoption of this regulation may be exempted in accordance with the following procedure:

(a) Operators of all-cargo service may petition the Authority for the exemption of services which are scheduled as of the date of the adoption of these regulations. The petition shall be made in a form to be prescribed by the Authority's Executive Director, and shall demonstrate:

1. That every reasonable effort has been taken to provide the service by an aircraft certificated in accordance with FAR Part 36; and

2. That an exemption for such service is essential to the economy of the New England region or a part thereof; and

3. That such service cannot reasonably be scheduled outside of restricted hours.

(b) Within ten(10) days of receiving such a petition the Executive Director shall post a notice at the Executive Offices of the Authority that such a petition has been received. Notice shall also be provided to each person whose name appears on the list maintained by the Authority under procedures for distribution of certain public notices set forth in Mass. Gen. Laws, Chapter 30-A, Section 3. The notice shall indicate the steps by which interested persons can inspect and comment upon the petition. A request for public hearing may be made by the petitioner or any interested person.

(c) Filing of such a petition shall automatically suspend the application of this regulation to the operations subject to the petition until such time as the Executive Director grants or denies the petition.

(d) The Executive Director shall grant or deny the petition, taking into consideration all the facts and circumstances bearing upon the need for non-Part 36 service and the environmental costs of such service including but not limited to:

1. The ability of the carrier, in view of its then-existing fleet composition and schedule, and the volume of its business to Logan, to provide such service by a Part 36 certificated aircraft; and
2. The importance of such service to the economy of the New England region or a part thereof; and
3. The possiblity that such service can reasonably be scheduled outside of restricted hours.

(e) An exemption granted by the Executive Director shall be for a term of not less than six (6) months and not more than two (2) years. Petitions may be reviewed at the expiration of an exemption.

ARTICLE IV - Noise Abatement Ground Procedures

A. Between the hours of midnight and 6:00 a.m., the Airport Manager may prohibit operation of any aircraft engine or aircraft electrical power generating device (except in conjunction with a flight arrival or flight departure) which generates a noise level in excess of 5dB above ambient at any noise monitoring system microphone located in or adjacent to a residential community. Failure to comply with the instruction given by the Airport Manager is a violation of this regulation.

B. Aircraft engine runups, except for reciprocating engine runups performed as part of pre-takeoff procedures, are prohibited between midnight and 7:00 a.m.

C. Aircraft engine runups (except for reciprocating engine runups performed as part of pre-takeoff procedures) shall not be performed between 7:00 a.m. and midnight, unless prior approval of the Airport Manager has been obtained. The Airport Manager shall not withold approval for performance of such operations at specific times and places as he shall designate and of which he shall provide notice to aircraft operators prior to the effective date of these regulations.

D. Idle power aircraft engine runups between the hours of midnight and 6:00 a.m. shall not be performed unless prior approval of the Airport Manager has been obtained. The Airport Manager shall not withold approval for performances of such operations at specific times and places as he shall designate and of which he shall provide notice to aircraft operators prior to the effective date of these regulations.

E. Aircraft taxiing to Runway 22R shall hold short of the designated noise abatement hold line on November taxiway, until cleared to proceed by Boston Tower. The hold line is identified by pavement marking and a sign reading, "Hold Point-Runway 22R".

F. Aircraft taxiing to Runway 27 shall hold short of the designated noise abatement hold line on Delta taxiway, until cleared to proceed by Boston Tower. The hold line is identified by pavement marking and a sign reading, "Hold Point - Runway 27".

G. The following noise abatement rules govern within the North Hangar area:

1. Jet engine starts and the taxiing of jet aircraft on the extension of Outer Taxiway or the Hangar Apron northwesterly of the fuel farms, is prohibited.

2. Jet aircraft departing the airfreight terminal ramps in the northwesterly corner of the North Hangar Area shall be pushed out to a position permitting straight out taxi, aligned with the North Apron Taxiway centerline.

3. Should the operation of APU's or GPU's be necessary between the hours of 11 p.m. and 7 a.m., the aircraft shall be positioned so that the APU exhaust or GPU equipment is shielded from the nearest residential area by the fuselage of the aircraft.

H. The following noise abatement rules govern within the South Hangar Area:

1. No jet or turboprop aircraft or helicopters shall be operated westerly of the east general aviation terminal ramp under their own power. The movement of such aircraft or helicopters beyond that point will be permitted only if under tow both in and out.

2. All jet and turboprop aircraft parked at the east general aviation terminal ramp shall be positioned on a heading of 310 degrees magnetic.

3. Should the operation of APU's or GPU's be necessary between the hours of 11 p.m. and 7 a.m., the aircraft shall be positioned so that the APU exhaust or GPU equipment is shielded from nearest residential areas by the fuselage of the aircraft.

I. Between the hours of 11 p.m. and 7 a.m. flight training operations including but not limited to practice approaches and takeoffs or landings shall not be conducted at the airport, exclusive of the initial takeoff and final landing of a training flight conducting such training activities elsewhere, for which takeoff or landing a temporary waiver has been granted by the Airport Manager.

J. Takeoffs from Runway 4L and landings on Runway 22R are restricted to light propeller driven aircraft with a maximum certificated gross takeoff weight of 12,500 pounds or less, except on infrequent occasions when use by

heavier aircraft is justified by unusual circumstances and when clearance for a specific aircraft has been issued by Boston Tower or a temporary waiver has been issued by the Airport Manager.

K. Intersection takeoffs by jet aircraft or aircraft exceeding 30,000 pounds maximum certificated gross takeoff weight are prohibited, except for departures from Runway 15R.

L. No pilot of a landing aircraft shall purposely allow his aircraft to touch down short of any designated displaced threshold, except that this requirement shall not apply to Runway 4R under day VFR conditions.

M. Pilots of jet aircraft who request and subsequently utilize a runway for landing or takeoff other than the preferential noise abatement runway initially assigned by Boston Tower shall upon request by the Airport Manager file a report justifying such use. The report shall be in a form satisfactory to the Airport Manager. Failure to file such report shall constitute a violation of this regulation.

ARTICLE V - Certain Ground Movements By Jet and Turboprop Aircraft not to be Conducted by Self-Propulsion

A. Definitions:

As used in this regulation, the following terms are defined as follows:

1. Aircraft Operating Movement: Any movement of jet or turboprop aircraft on the ground directly to or from a runway in connection with a takeoff or landing by that aircraft.

2. Aircraft Repositioning Movement: Any movement of a jet or turboprop aircraft on the ground which is not an Aircraft Operating Movement.

B. Within the daily time periods established by the following compliance schedule, no aircraft repositioning movement shall be conducted by self-propulsion.

Compliance schedule:

Commencing February 1, 1977 - 7:00 p.m. - 7:00 a.m.
Commencing July 1, 1977 - 24 hours per day

C. Within the daily time periods established by the following compliance schedule, no aircraft operating movement (except for arrivals or departures from South Terminal gates 4, 6, 8, 10, 12, and 13) shall be conducted by self-propulsion westerly of an area near the Airport Fire Station designated by the Airport Manager as the area for towing initiation (inbound) or towing termination (outbound).

Compliance Schedule: Departing Aircraft

Commencing February 1, 1977 - Midnight - 7:00 a.m.
Commencing April 1, 1977 - 11:00 p.m. - 7:00 a.m.
Commencing July 1, 1977 - 7:00 p.m. - 7:00 a.m.

Commencing January 1, 1978, this regulation shall apply to departing aircraft twenty-four hours per day. The Executive Director upon notice to be given not later than November 30, 1977 based on a finding that an extension is necessary to permit implementation of the program without undue congestion or delay, may extend until June 30, 1978, the commencement date for twenty-four hour application of this compliance schedule.

Compliance Schedule: Arriving Aircraft

Commencing February 1, 1977 - Midnight - 7:00 a.m.
Commencing July 1, 1977 - 11:00 p.m. - 7:00 a.m.
Commencing October 1, 1977 - 7:00 p.m. - 7:00 a.m.

Commencing January 1, 1978, this regulation shall apply to arriving aircraft twenty-four hours per day. The Executive Director upon notice to be given not later than November 30, 1977 based on a finding that an extension is necessary to permit implementation of the program without undue congestion or delay, may extend until June 30, 1978, the commencement date for twenty-four hour application of their compliance schedule.

D. An aircraft prohibited from using self-propulsion under this regulation shall not operate any engine used in propulsion while engaged in an aircraft operating movement or an aircraft repositioning movement.

E. Except in cases of a safety emergency, no tug or tractor shall tow an aircraft unless two-way radio communication is maintained with the Control Tower on appropriate frequencies in use.

F. Upon request, the Airport Manager may exempt from the restrictions on aircraft operating movements an aircraft which is not equipped with an APU.

G. The restrictions on aircraft operating movements and aircraft repositioning movements in this Article may be temporarily suspended by the Airport Manager if required to alleviate congestion or delays on the aircraft movement areas or be automatically suspended when snow, ice or slush on operating pavement surfaces impedes proper operation of towing procedures.

H. The operator of an aircraft with an inoperative APU may obtain a waiver permit from the Airport Manager for an aircraft operating movement.

I. The Executive Director shall maintain a program of monitoring and evaluation of towing for noise abatement purposes and shall periodically report his findings to the Authority.

ARTICLE VI - Other Local Operating Restrictions

A. Between the hours of midnight and 6:00 a.m., jet and turboprop aircraft landing on any runway except 4R shall exit the landing runway only at its physical end.

B. Night Time Preferential Runway.

1. Between the hours of 12:00 p.m. and 6:00 a.m., aircraft shall use Runway 15R for takeoff and Runway 33L for landing whenever the following limiting criteria prevail:

(a) Crosswind component not exceeding 15 knots and downwind component not exceeding 10 knots.

(b) Minimum feasible ceiling consistent with FAA safety determinations.

(c) All required navigational aids are in operation when IFR conditions prevail.

(d) Runway length exceeds minimum permissible for the aircraft at its operating weight, taking into account wind and weather conditions. The aircraft Captain will make this judgment in keeping with Federal Aviation Regulations, Aircraft Operating Manuals, and company procedures.

(e) When the downwind component exceeds 5 knots but not in excess of 10 knots, the following additional criteria apply:

(i) Visibility not less than ½ mile/2600 feet RVR.
(ii) Runway pavement is clear and dry.

C. Any pilot who refuses an assignment to runway 33L or 15R when the criteria set forth in B.1.(a.) - (e) prevail, shall upon request file a report with the Manager stating the reasons in support of his judgment for not using the noise abatement preferential runway assigned. The report shall be on a form satisfactory to the manager. Failure to file the foregoing report shall be a violation of these regulations.

D. When the limiting criteria set forth in B.1.(a.) - (e) above do not prevail, the next most preferential landing or takeoff runway shall be used. These runways in order of selection priority shall be in accordance with the current nocturnal hour preferential runway system prescribed by FAA.

E. Hours of applicability will be expanded to the period of 11:30 p.m. to 6:30 a.m. effective June 1, 1977, and to the period of 11:00 p.m. to 7:00 a.m. efective January 1, 1978, if operating experience indicates this can be accomplished without adverse impact on safety and runway capacity requirements. Notice of the extension of hours of applicability will be published thirty days prior to the extension.

ARTICLE VII - Provision of Certain Data to Airport Manager

A. For purposes of this Article, the term "operation" is defined as a landing or a takeoff.

B. Each aircraft operator conducting six or more operations at Logan Airport in a calendar month shall submit to the Authority certain information which is required by the Authority in administrating and monitoring the Logan Airport noise abatement program. The information for each operation shall include information on the flight, the aircraft and particular Logan operation. An

operator of an aircraft under 75,000 maximum certificated gross landing weight may request an exemption from this report requirement on a form satisfactory to the Airport Manager. The Airport Manager may waive this reporting requirement for operators of aircraft of less than 75,000 maximum certificated gross landing weight or of such lesser cut-off weight as he may deem appropriate. Failure to file the foregoing monthly report shall constitute a violation of these regulations.

ARTICLE VIII - Severability of Provisions

If any provision of these rules and regulations or the application thereof to any aircraft operator is held unconstitutional or otherwise unlawful by any court of competent jurisdiction, the remainder of these rules and regulations and their application to other operators shall not be affected thereby.

ARTICLE IX - Penalties for Violations

Article VI of the Authority's by-laws provides in pertinent part as follows:

4. For violations of AIRPORTS RULES AND REGULATIONS

PART E - LOGAN AIRPORT NOISE ABATEMENT RULES AND REGULATIONS

ARTICLE I.

The penalty for violation of this regulation shall be $2,000 per operations.

ARTICLE II.

The penalties for violation of this Article shall be as follows:

For failure to file an implementation plan, the penalty shall be not less than $250 and not more than $500. Each day the plan is in default shall constitute a separate violation.

For violation of Sub-Part H, sub-paragraph 8, (failure to file a monthly report), the penalty shall be not less than $150 and not more than $250. Each day the report is in default shall constitute a separate violation.

For violation of Sub-Part G, (failure to attain Monthly Compliance Ratio) the penalty shall be not less than $150 and not more than $250 per operation by which actual Part 36 operation fall short of the Part 36 operation component of the Monthly Compliance Ratio.

ARTICLE III.

The penalty for violation of Part A of this Article shall be not less than $250 and not more than $500 per operation.

ARTICLE IV

The penalty for violation of any part of this regulatoin shall be according to the following schedule. For purposes of this section, fines assessed against individuals shall be assessed with regard only to prior infractions by that individual, and fines assessed against aircraft operators shall be assessed with regard to the cumulative infractions incurred by the agents and employees of that operator. Infractions of one lettered sub-part of this Article shall not be cumulated with infractions of other lettered sub-parts for purposes of applying this schedule of penalties.

Each offense: Not less than $50 and not more than $100.

1st subsequent offense within 12 months: Not less than $150 and not more than $250.

Additional subsequent offenses within 12 months of two or more other offenses: Not less than $300 and not more than $500.

ARTICLE V

The penalty for violation of any regulation in this Article shall be assessed according to the following schedule.

For purposes of this section, fines assessed against individuals shall have regard only to prior infractions by that individual, and fines assessed against aircraft operators shall be assessed with regard to the cumulative infractions incurred by the agents and employees of that operator.

Each offense: Not less than $40 and not more than $100.

1st subsequent offense within 12 months or two or more other offenses: Not less than $300 and not more than $500.

ARTICLE VI

The penalty for violation of Part A of this regulation shall be not less than $150 and not more than $500. The penalty for failure to file the report required by Part C of this regulation shall be not less than $100 and not more than $250.

ARTICLE VII

The penalty for failure to submit the information required by Part B of this Article shall be $500. Refusal shall constitute a separate offense for each calendar month.

APPENDIX G

FAA PREFERENTIAL RUNWAY PROCEDURES

FAA PREFERENTIAL RUNWAY PROCEDURES

SECTION 2 - RUNWAY USE

20. RUNWAY SELECTION PRIORITY

a. NORMAL PERIODS (0600 - 2359L)

(1) Boston Tower will assign runways in accordance with the following table of priorities only under the following conditions:

(a) Crosswinds do not exceed 80°.
(b) Wind velocity is not more than 15 knots.
(c) Runways are clear and dry.

NORMAL TRAFFIC PERIODS

PRIORITY	LANDINGS	DEPARTURES
1	4R/L	15R-9
2	27-22L	15R-22R/L
3	33R/L	27
4	15R/L	15R-9

b. NOCTURNAL HOURS (0000 - 0600L)

(1) Boston Tower will assign the following runways under the following conditions:

(a) Maximum tailwind component is 5 knots.
(b) Total wind velocity does not exceed 15 knots.
(c) Runways are clear and dry.
(d) Weather is basic VFR (1000 feet ceiling and 3 miles visibility).

PRIORITY	LANDINGS	DEPARTURES
1	33L	15R

c. Whenever the conditions noted above do not exist, the next lower priority runway possible will be selected, as follows:

LANDINGS	DEPARTURES
4R	9
22L	22L/R

d. Additionally, during the nocturnal hours, all aircraft, regardless of size, will be required to utilize the full length of all departure runways, with the exception of Runway 15R.

e. Landings on Runway 22R and takeoffs on Runway 4L remain the lowest priority for runway selection and shall be utilized for aircraft 12,500 pounds and above only when a significant operational requirement or emergency condition exists. However, during the nocturnal hours indicated, Runway 22R shall not be utilized for landings and no departures shall be assigned Runway 4L regardless of type, unless no other runways are available.

f. The pilot retains the final authority for runway selection. If, in the interest of safety, the pilot determines that a runway other than that assigned should be used, controllers will approve the request.

21. SEPARATION STANDARDS FOR PARALLEL RUNWAYS 4/22

a. Whenever a heavy turbojet aircraft is landing or departing on Runway 4R/22L, the separation standards which shall be applied will be those which consider the parallels as a single runway; that is, the four, five or six mile criteria.

b. For all other types of aircraft, no wake turbulence separation will be required. That is, a small aircraft may land runway 4L immediately behind a large aircraft landing 4R without any additional separation being provided for possible turbulence.

22. RUNWAY ASSIGNMENT

a. Category III aircraft shall be assigned the primary runway for arrival and departure.

b. Category I and II aircraft shall be assigned a secondary runway for arrival and departure.

c. Designated primary and secondary runway configurations:

DEPARTURE		ARRIVAL	
Primary	Secondary	Primary	Secondary
33L	33R	27	33L
4R	4L	9	4L/15R
27	22L	22R	15R
22L	27	22R	15R
15R	15L	9	

REFERENCES

REFERENCES

1. Massachusetts Port Authority. Air Traffic Statistics 1977, 1978.

2. Coverdale and Colpits. 1972. Logan Airport Travel Study.

3. SMSA. 1970 Census of Population and Housing. Boston Census Tract.

4. Metropolitan Area Planning Commission. 1972. Boston Harbor Islands Comprehensive Plan.

5. Process Research Inc. 1976. Environmental Impact Assessment and Water Quality Analysis of Charles River and Boston Harbor.

6. U.S. Environmental Protection Agency. 1978. Mobile Source Emission Factors.

7. Personal Communication with David Gordon, P.E., David Gordon Associates, Inc. 1979.

8. Norco, J.E., et.al. 1973. An Airport Impact Methodology for Airports - Phase I. U.S. Environmental Protection Agency.

9. U.S. Environmental Protection Agency. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Office of Noise Abatement and Control.